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OF THE

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CONTENTS

PAGE

Aaron Dr. C. D. Treatment of Intestinal Stasis....44
Aaron, Dr. C. D. Discussion 70, 71
Acid, Phenylcinchoninic, Therapeutics of 144
Addiction, Drug, and its Treatment 102
Address of Welcome 25
Address of Welcome, Response to the 26
Address of the President 28
Anderson, Dr. H. B. The Relationship of Oral Sepsis to Systemic Disease and its Bearing on Treatment.... 87
Anderson, Dr. H. B. Discussion 86
Auricular Disease, Ipecacuanha in the Treatment of....165
Auricular Fibrillation, On the Differentiation of, and its Treatment....168
Babcock, Dr. W. W. Address of the President; Notes on the Surgical Treatment of Empyema 28
Babcock, Dr. W. W. Discussion 69
Barnes, Dr. N. P. Discussion 69, 85, 86
Beates, Dr. H. A Clinical Study of the Variable Therapeutic Potencies of the Galenicals and their Inherent Unreliability 119
Beates, Dr. H. Discussion 99, 108, 180
Bishop, Dr. L. F. The Place of Ipecacuanha in the Treatment of Auricular Disease 165
Cornwall, Dr E. E. Some Points in the Management of Diseases of the Heart....158
Cornwall, Dr. E. E. Discussion 180
Dawes, Dr. S. L. Modern Therapeutics in the N. Y. State Hospital for the Insane 109
Differentiation of Auricular Fibrillation and its Treatment 168
Diner, Dr. J. Discussion 66, 85, 178
Diner, Dr. J. Drug Addiction and its Treatment 102
Diseases of the Heart, Some Points in its Management 158
Duodenal Ulcer, The Treatment of 36
Empyema, Notes on the Surgical Treatment of 28
Freeman, Dr. E. B. Discussion 72
Fibrillation, Differentiation of Auricular and its Treatment....168
Friedman, Dr. Jacob, Obituary of 26
Galenicals, A Clinical Study of 119
Gallstone Disease, Modern Treatment of 47
Heart, Some Points in the Management of Diseases of the....158
Hemmeter, Dr. J. C. Modern Treatment of Gallstone Disease, etc. 47
Hitchins, Dr. A. P. Sera and Allied Materia Medica in War Time.... 72
Hitchins, Dr A. P. Discussion 87
Intestinal Stasis, Treatment of 44
Intubation, Duodenal, etc. 47
Ipecacuanha in the Treatment of Auricular Disease....165
MacFarlane, Dr. A. Neuro-circulatory Myasthenia 147
MacFarlane, Dr. A Discussion 182
McGuire, Dr. E. Discussion 67, 86, 99

Members, Roster of ..... VII.
Members, Deceased ..... XV.
Modern Therapeutics in the N. Y. State Hospital for the Insane..... 109
Morris, Dr. R. T. Response to the Address of Welcome 26
Morris, Dr. R. T. Surgery in its Relationship to Psychoses and Psychoneuroses.. 100
Myasthenia, Neuro-circulatory 147
Neuro-circulatory Myasthenia 147
Obituaries 26
Officers 1918-19 ..... V.
Officers, Election of 184
Oral Sepsis,The Relationship of, to Systemic Disease 87
Ouabain, Strophanthin Gratus, Therapeutic Action of 125
Papers Read by Title 184
Phenylcinchoninic Acid, Therapeutics of 144
Pneumonias, The Serum and Vaccine Treatment of 74
Porter, Dr. W. H. A Unique Case of Rheumatism and its Management..... 114
Presidents, Past .. .. XIV.
Psychoses and Psychoneuroses, Surgery in its Relation to 100
Relationship of Oral Sepsis to Systemic Disease..... 87
Reilly, Dr. T. F. Obituary of Heinrich Stern 27
Reilly, Dr. T. F. Discussion 67, 84
Response to Address of Welcome 26
Rheumatism, A Unique Case and its Management..... 114
Roster of Members ..... VII.
Satterlee, Dr. R. G. Treatment of Duodenal Ulcer 36
Satterlee, Dr. R. G. Discussion 71, 86
Satterthwaite, Dr. T. E. The Differentiation of Auricular Fibrillation and its Treatment 168
Satterthwaite, Dr. T. E. Discussion..... 183
Sepsis, Oral, Relationship to Systemic Disease 87
Sera and Allied Materia Medica in War Time 72
Serum and Vaccine Treatment of the Pneumonias 74
Sprigg, Dr. W. M. Discussion 100
Stasis, Intestinal, Treatment of 44
Stern, Dr. Heinrich, Obituary of 27
Stewart, Dr. E. S. Discussion 67
Strophantin Gratus, Therapeutic Action of 125
Surgery in Relation to Psychoses and Psychoneuroses 100
Taylor, Dr. L. H. Discussion 69, 86
Therapeutics, Modern, in the N. Y. State Hospital, etc. 109
Treatment of Drug Addiction 102
Treatment of Duodenal Ulcer 36
Treatment of Gallstone Disease 47
Treatment of Intestinal Stasis 44
Tucker, Dr. B. R. Address of Welcome 25
Tucker, Dr. B. R. Discussion 99
Ulcer, Duodenal, Treatment of 36
Vaccine, the Serum and Vaccine Treatment of Pneumonias 74
Vanderhoof, Dr. D. Discussion 66, 198
Wilcox, Dr. R. W. Therapeutics of Phenylcinchoninic Acid 144
Zueblin, Dr. E. Obituary of Jacob Friedman 26
Zueblin, Dr. E. Therapeutic Action of Ouabain 125
Zueblin, Dr. E. Discussion 65, 85, 86, 108, 179, 181

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Organized, May 1, 1900
Incorporated, July 7, 1904

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Atlantic City, on June 6-7, 1919

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January, 1918

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10. Bass, Charles C.	Biology and Chemistry	Prof. Experimental Medicine, College of Medicine Tulane Univ.	A. M. Physicians	3513 Prythoma St., New Orleans, La.
11. Beates, Henry, Jr.	State Medicine	Ex-Pres. Nat. Confed. of State Examining Boards, etc. Ex-Pres. State Bd. Med. Exam.	A.M.A., Amer. Acad. of Polit. Sciences., Am. Acad. Med.	260 S. 16th St., Philadelphia, Pa.

12. Bishop, Louis Faugeres	Diseases of Chest	Prof. Dis. of Heart, etc., Fordham Univ., Phys. to Lincoln Hosp., etc.	A.M.A., F.A.C.P.	109 E. 61st St., New York, N. Y.
13. Blackader, Alexander Dougall	Pharmacol & Ther., & Dis. of Children	Lect. Dis. of Child. & Prof. Ther. & Pharm., McGill Univ., Phys. to Children's & Montreal Gen. Hosps., etc. Pres. Can. Med. Asso.	A.M.A., Amer. Phys., Amer. Climat.	236 Mountain St., Montreal, Canada.
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88.	Vander Veer, Albert	Surgery	Emeritus Prof. Surg. Albany Med. Coll., Amer. Surg.-in-chief Albany Hosp., etc., Ex-Pres. A. M. A.	A.M.A., Amer. Surg. Ass'n.	28 Eagle St., Albany, N. Y.
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92.	Wilcox, Reynold Webb	Internal Medicine	Formerly Prof. Med. N. Y. Post-Grad. Med. Sch. & Hosp., Consult. Phys. to St. Mark's and other Hospitals.	Am. Cong. on Internal Med., F.A.C.P., Am. Asso. Med. Jour.	679 Madison Ave., New York, N. Y.
93.	Wiley, Harvey W.	Chemistry	Prof. Agricultural Chem., Geo. Wash. Univ.	Amer. Chem. Soc.	Cosmos Club, Washington, D. C.
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Noble P. Barnes	Washington, D. C.	1912-13
Howard van Rensselaer	Albany, N. Y.	1913-14
Francis M. Pottenger	Los Angeles, Cal	1914-15
Robert T. Morris	New York, N. Y.	1915-16
Josiah N. Hall	Denver, Colo.	1917-18
W. Wayne Babcock	Philadelphia, Pa.	1918-19

*Deceased.

DECEASED MEMBERS

Samuel Claggett Busey, M.D., LL.D., died Oct. 19, 1899.
William P. Manning, M.D., died Feb. 9, 1901.
John Thomas Winter, M.D., LL.D., died June 22, 1902.
George Edward Tyler, M.D., died July 7, 1902.
Robert Henderson Graham, M.D., died Aug. 24, 1903.
George Bingham Fowler, M.D., died March 6, 1907.
John S. McLain, M.D., died June 2, 1907.
Robert Reyburn, M.D., died March 25, 1909.
Justin Steer, M.D., died March 25, 1909.
Howard H. Barker, M.D., died May 8, 1910.
John Veitch Shoemaker, M.D., died October 11, 1910.
Carl Beck, M.D., died June 8, 1911.
Henry Alfred Robbins, M.D., died October 26, 1911.
John Herr Musser, M.D., died April 3, 1912.
Louis Nelson, A.M., M.D., died April 14, 1912.
Frederick Forchheimer, M.D., died June 1, 1913.
Louis Kolipinski, M.D., died December 14, 1914.
Charles E. Woodruff, A.M., M.D., died June 13, 1915.
Peter Brynberg Porter, A.M., M.D., died August 5, 1915.
Henry L. Elsner, M.D., died February 17, 1916.
Julius H. Eichberg, M.D., died November 2, 1916.
George Ben Johnston, M.D., died December 20, 1916.
Heinrich Stern, M.D., died January 30, 1918.
Jacob Friedman, M.D., died April 13, 1918.
Robert Coleman Kemp, M.D., died Oct. 23, 1918.

NINETEENTH ANNUAL MEETING

Held at Richmond, Va.

June 7 and 8, 1918

DR. W. WAYNE BABCOCK, of Philadelphia, Pa., in the Chair.

REPORT OF COMMITTEE ON ADMISSIONS

DR. THOMAS E. SATTERTHWAITE, Chairman.

ADDRESS OF WELCOME

The Address of Welcome was delivered by Dr. Beverley R. Tucker of Richmond, Va., who said that Richmond possessed many historical associations. It was near here that the Indian maiden, Pocahontas, saved the life of Captain John Smith, when he came here to seek supplies for the early settlers who were starving in the Jamestown colony. Here Nathaniel Bacon had his quarters, and from here this leader sallied forth to strike the first blow for American liberty against the tyranny of the English crown. Here Patrick Henry made his speech for American liberty which rang around the world. The government of the confederacy was situated in this city. Coming on to later times one found men no less deserving of fame. The late Dr. George Ben Johnston was the chief spirit in building up and equipping the medical College of Virginia. Three present hospitals were organized by him. His wonderful personality tended to elevate the ideals of the profession and his influence spread through this whole section and into all the Southern states. He stood for all that was fine and true and high in medicine and his life would remain an enduring influence for those principles. Fifty years ago the battlefields around Richmond were soaked with the blood of brothers fighting for the principles of civil life. To-day, their sons were fighting for the common cause of humanity so that the principles of freedom might live and have breathing space upon the face of the globe. The American Therapeutic Society, meeting here to-day, had two duties to perform: first, the inauguration of a method of combating the terrible spread of disease that was the scourge of every war; second, to aid the people at home by keeping up the highest standards of this scientific association. With these ends in view they had come together to-day. The City of Richmond extended to this society, individually and collectively, the welcome of the profession and also all the social welcome that such a community could afford.

RESPONSE TO THE ADDRESS OF WELCOME

The response was made by Dr. R. T. Morris of New York, who said that the old ideal of character was to combine utility with piety. This society aimed to combine science with good fellowship. The spirit of American social life was very apparent in Richmond. There was a thinning of the ranks of the society on this occasion. This was due to high idealism. It was because the country as a whole was engaged in a fight for the supremacy of idealism over materialism that the membership was so depleted. As a whole the members of this society had shown their willingness to stand in the forefront of the fight. The welcome extended to them by the members of the profession at Richmond had made them feel quite at home.

OBITUARIES

JACOB FRIEDMAN, M. D.

By DR. ERNEST ZUEBLIN
Cincinnati, O.

Dr. Jacob Friedman was born in St. Louis in April, 1856, where he received his primary education in the public schools, graduating from the High School in 1873. After successful studies at the Washington University from 1873 to 1876 he obtained the degree of Chemist from the same institution. In order to pursue his studies successfully Dr. Friedman taught in night school, so supporting himself throughout his academic course. In 1878 the St. Louis Medical College conferred upon the young promising scientist the degree of M.D. While interne at the St. Louis City Hospital and as resident physician in the Quarantine Hospital, Dr. Friedman, by his skill and courage, distinguished himself during the great yellow fever epidemic. This achievement deserves the recognition of the profession since the danger of becoming a victim of that deadly disease was no reason for the young doctor to shrink away from the great responsibilities of such a position. Dr. Friedman's career as teacher is very interesting. As the years passed by we see him steadily advance to higher and more important positions. In 1879 Dr. Friedman was appointed Demonstrator in Chemistry in the St. Louis Medical College and in the Washington University. In 1884 he became Adjunct Professor of Chemistry, which position he successfully filled until 1892, when he was appointed Professor of Chemistry in the Beaumont Hospital Medical College. After the consolidation of that institution with the Marion Sims College of Medicine under the new name of the St. Louis University School of Medicine, Dr. Friedman remained in the same position until 1904, when the same

institution was anxious to have him as Professor of Therapeutics. Not only along the line of teaching and in Science were Dr. Friedman's qualities highly appreciated; in charge of the Medical Service of the Alexian Brothers his professional services were in great demand from 1897 to 1903. From 1902 to the time of his unexpected death, Dr. Friedman was Physician in Chief of the Jewish Hospital of St. Louis. Although Dr. Friedman as a citizen of St. Louis devoted most of his work and services to his native city, by his extensive travels in Europe and by his keen interest in medical science he added a great deal to his skill and medical knowledge. Devoted to his profession, to his patients, a man of the highest character, it was not surprising that in the course of his work he acquired a great following. Beloved by his patients, noted and well known for his patriotism and enthusiasm, well appreciated in his great integrity, his bluff honesty found a devoted following among the profession.

The above notes are only a short review of Dr. Friedman's work which will be remembered among his colleagues and friends. A successful, rich life has come to an unexpected and too early stop, and while we, the members of the American Therapeutic Society, pay our full admiration to the deceased member whom we will miss in our gatherings, we feel with the wife and family of Dr. Friedman the great loss of his death. The remembrance of him as a colleague, physician, teacher and friend will, however, remain as a stimulating example for those who are left of the ethical heights to which a noble profession may lead.

HEINRICH STERN, M. D.

By DR. THOMAS F. REILLY
New York

Heinrich Stern was born near Frankfort, Germany, 50 years ago. Because his father had been bold enough to oppose the Prussianization of his native state, he was taught the meaning of *Schrecklichkeit*. As soon as his sons were able to travel the father literally drove them from the land of the oppressor, so that they might not experience a fate like unto his own. Soon after arriving in this country, Dr. Stern began the study of medicine. He received his first medical degree 24 years ago. A few years later he took a second degree. After some years in general practice he began to devote himself to a study of the diseases of metabolism. The prize offered by the New York County Medical Society for the best essay on "diabetes" was won by him and this brought him to the notice of the profession. From that time his work was consistently in the field of internal medicine.

He was connected either as founder or member with the following organizations: The Institute for Medical Diagnosis, and Philantropen

Hospital; Visiting Physician, St. Mark's Hospital; Consulting Physician, Central Islip and Seney Hospitals; Sometime Professor of Clinical Medicine, at the German West Side Post Graduate Medical School; Lecturer on Medicine, Boston University; Founder and Editor of the *Archives of Diagnosis;* Founder of the Manhattan Medical Society and of the American College of Physicians, which was the culmination of a life-long dream. In addition he was a member of a dozen other medical societies. He was the author of upwards of 300 medical articles and of half a dozen text books on medicine, most of which were devoted to treatment in its various phases.

Dr. Stern's life was marked by unabated industry both in the line of original studies and the self-imposed exactions of his profession. He was an omnivorous reader with a most tenacious memory. Time and again he made a lasting impression on his fellows by quoting extensively from an article written by a friend, mayhap a decade or two previously and mostly forgotten. He was a strong character; positive in his likes and dislikes; honest in his purpose and often misunderstood. The fatal illness which hung as a shadow over Dr. Stern ever since about the time of his election to this society, prevented his active participation in its deliberations but his interest remained to the end and its aims and purposes were always uppermost in his mind.

SCIENTIFIC PROCEEDINGS*

VICE-PRESIDENT, DR. EDWARD D. FISHER, in the Chair.

ADDRESS OF THE PRESIDENT

Notes on the Surgical Treatment of Empyema

By W. WAYNE BABCOCK, Lieutenant Colonel, M. C., U. S. A.

Pleural effusions so prevalent in the various army camps and cantonments during the past winter have been associated with a mortality so high as to demand special consideration. The effusions for the most part have occurred after measles and croupous pneumonia, and have given an average mortality of 31 per cent., but in some camps it has reached 65 per cent., 84

*It is to be understood that the Society does not hold itself responsible for any views expressed by the readers of papers or participants in discussions.

per cent., and even 100 per cent. The microorganism chiefly responsible, and giving unusual features to the epidemic is the *Streptococcus hemolyticus*.

Three periods characterize the epidemic as to time and virulence: First, the period of November, December, and January, which marked the greatest intensity of the disease. At this time a typical clinical picture is that of a patient convalescent from measles, who, after exposure, develops thoracic oppression and dyspnea. There is slight lividity, deepening into cyanosis, with evidence of a rapid outpouring of serum into one or both pleural cavities and perhaps also into the pericardium and peritoneum. Loud, moist rales are heard over the chest, and the respiration grows progressively more difficult and more superficial. The effused fluids teem with streptococci, and at times the microorganism may be recovered from the circulating blood. In from 24 to 72 hours the patient is dead. At the post mortem the lungs show large areas of congestion and edema. There are some purulent bronchitis and peribronchitis. In some cases the lungs are necrotic. The effusions in the serous cavities are seropurulent. The process is so rapid that a definite pneumonic process or true pyothorax usually is not found. After the onset of the disease the patient is usually too weak to stand any formidable operation, and has an infection too generalized to be benefited by simple aspiration. Should the patient, however, survive the early stages of infection, consolidation of lung, pulmonary abscess, and purulent infection of the various serous cavities may occur.

The second period of streptococcus infection as to virulence began the latter part of February and extended into April. While serious, the epidemic had lost its intense virulence, and the patients lived long enough to develop other lesions. Usually the patient did not develop the acute and tragic symptoms, and the serous pleural effusions progressed after from several days to one or two weeks to a purulent stage. Pneumonia consolidations and pulmonary abscesses not infrequently occurred, and metastatic effusions in other large serous cavities or in the joints. In the joints the results varied from complete disorganization to spontaneous subsidence with only moderate stiffness. At times there were pyemic manifestations, including multiple subcutaneous abscesses of mild virulence containing streptococci, and promptly healing after simple incision, as in typhoid fever. The presence of streptococci in the blood, while ominous, was not always of fatal import.

In April the third stage of the epidemic was observed. While the *Streptococcus hemolyticus* was still the predominating organism, a pyothorax was the chief lesion, but it usually was amenable to treatment, and death was rare.

The virulence of the epidemic, therefore, bore a direct ratio to the coldness of the months and the microorganism also apparently progressively attenuated as the epidemic advanced. Not only were the infections more

severe and more fatal in the early winter months, but they were more enduring and more resistant to treatment, so that empyemas starting in the early winter not infrequently continued to drain until spring or summer, while those beginning late in the epidemic often closed first. In part this may be the result of better management, but irrespective of the treatment it is evident that the late cases were much less virulent and much more amenable to treatment than those of the early months of the epidemic. Not only this, but patients bore the larger thoracoplastic operations or decortications much better in the spring than in the winter. Statistics on methods of treatment which do not take into consideration the rapid attenuation of bacterial virulence as the epidemic progressed have little value. To this attenuation we may largely ascribe the wide diversity of surgical opinion. Thus we find in some camps where surgeons operated promptly during the first part of the epidemic, and operated less promptly and less frequently as the epidemic progressed, the opinion that early operation was responsible for the high mortality. Again, if, during the early weeks of the epidemic, few operations were done and prompt surgical treatment was instituted only after post mortems had revealed the large pleural effusions present in similar cases, the surgeon was prone to argue that the mortality was due to delay in operating. If the surgeon aspirated early in the epidemic, and began to reset ribs at a later stage when the virulence had declined, he concluded that aspiration was dangerous and a cause of bacteremia. If, on the other hand, the surgeon resected first and then later, on account of the overwhelming mortality, began to do more aspirations and to practise delay, he concluded from his increasingly favorable results that aspiration was the safer and better procedure.

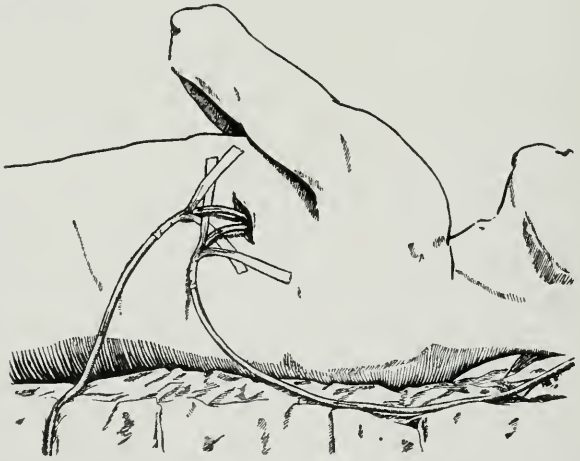

FIG. 1.—Arrangement of tubes for Carrel-Dakin treatment of empyema. Skin incised under local anesthetic and two rubber tubes introduced through an intercostal space by means of a large trocar.

Unfortunately, our results in handling these pleural effusions have been too poor, our experience too limited, to permit fixed conclusions, but the plan thus far worked out is as follows:

1. For sudden serous effusions, with cyanosis and marked dyspnea of streptococcic origin, no treatment or simple paracentesis to relieve pressure temporarily. As showing the early virulence, of eight cases treated by aspiration or puncture drain seven died, one patient recovering after a single aspiration of a small quantity of thick pus.

2. *Dakin Irrigation.*—For acute serous or seropurulent effusions a single thorough irrigation with Dakin's fluid, under local anesthesia by 1 per cent. procaine, is used. Two rather stiff rubber tubes, size 18 to 25 F, are introduced into the cavity. A large, short trocar is employed, the tubes being carried into the cavity through the cannula. The skin is incised and the trocar introduced into the cavity at two points. The tubes are introduced separately and the cannula withdrawn, leaving the tubes in place. One tube has its outlet dependent and under fluid, the other is attached to a sterile funnel containing warm Dakin's fluid. Without permitting air to

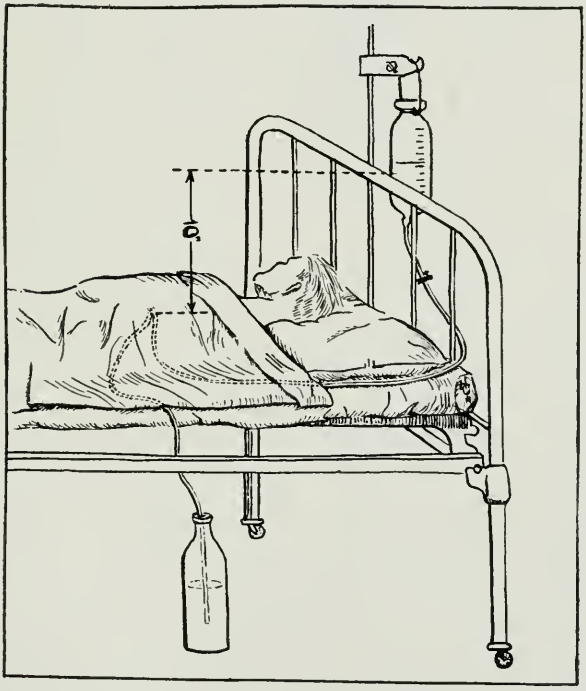

FIG. 2—Showing arrangement of apparatus for Carrel-Dakin treatment of empyema.

enter, the irrigation is continued with a pressure head of fluid not greater than 10 inches until the faint tint of the permanganate color of the Dakin fluid is observed at the outlet. The chest is now emptied, the tubes with-

drawn, and the puncture openings dressed with gauze wet with dichloramine-T in chlorcosane. The later management of the case depends upon the possible return of the fluid and on its character. Repeated X-ray studies are of especial value in association with aspiration and the usual methods of physical examination. Of four cases treated by a single antiseptic irrigation one died and two recovered without further operation.

3. *Continuous Carrel-Dakin Treatment.*—Empyemas with creamy or curdy pus are treated by introducing under local anesthesia by means of a large trocar, stiff rubber tubes, size 30 to 36 F., with a terminal and one lateral opening. The tubes are graduated with indelible ink before sterilization, so that their depth of introduction may always be evident. They are passed through the same or contiguous intercostal spaces to a depth just

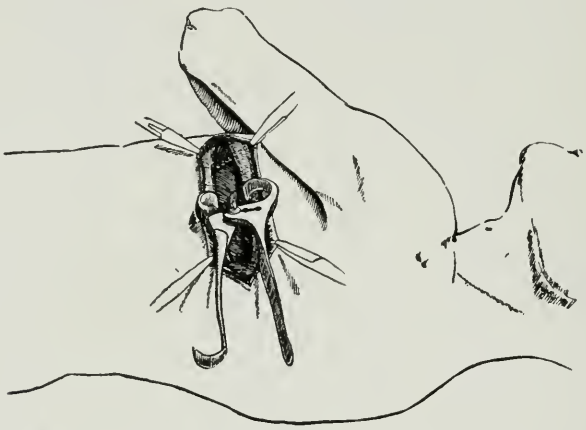

FIG. 3.—Explanatory thoractomy, with rib spreading. Long intercostal incision and rib spreader in place. Seven centimeters of separation may be obtained.

sufficient to place the lateral opening well within the cavity. One tube is fastened to a Dakin reservoir, the other empties under solution in a container placed under the bed (Fig. 1). The tubes are fastened to the chest wall by adhesive plaster (Fig. 2). The height of the surface of the Dakin should not be more than 10 inches above the chest cavity. Every two hours from 50 to 200 c.c. of the Dakin solution is permitted to enter the pleural cavity. This should not produce pain and often will not arouse the patient if asleep. About 1/5 or ¼ more fluid escapes than enters the chest, due to the aspirating action of the drainage. As a rule the tubes remain nearly water tight where they pass through the chest wall. The method is therefore very clean and convenient and only a small dressing is required. Under the treatment, pus and curdy masses are dissolved, there is no odor, and the drainage becomes clear and gelatinous. In the early days of the treatment there may be rises in temperature, but the patient should rapidly

improve and show a marked increase in appetite and comfort, with gain in weight. If the treatment is painful or the drainage imperfect the tubes should be promptly readjusted, reintroduced at some new point, or discarded in favor of some other form of treatment. Excessive pressure in instillation or improperly placed tubes may cause pain, extension of the pleural inflammatory process, or leakage into the subcutaneous or muscular tissues with the possible production of an axillary or subpectoral abscess. Large tubes by pressure may also cause necrosis of adjacent ribs. To prevent leakage under the skin it is wise to make the skin incision distinctly wider than is necessary for the introduction of the tubes. The object is to sterilize the cavity, and the tube should be withdrawn as soon as clinical sterility is accomplished. A bacteriological count may be made by irrigating the cavity, with one per cent. sodium thiosulphate solution to neutralize the Dakin fluid; cultures are made from the last washings that pass from the drainage tubes.

Of eleven patients treated in this manner, two died, six were healed without other forms of operation, one required secondary thoracostomy, one a costatectomy, one a pulmonary decortication. Five of the patients have returned to duty and one is healed awaiting discharge; three having had secondary operations are now nearly healed. This mortality of 18 per cent. compares well with the average mortality of 32.4 per cent. obtained in treating 37 cases by various methods. The duration of the irrigation in these cases was from two days to four months. After removal of the large irrigation tubes it was found wise to insert small 4-mm. Dakin tubes in the openings and to continue Dakin irrigation for two or three days to sterilize the tube tracts. The use of dichloramine-T in these openings has not been found so valuable.

4. *Double Tube Drainage.*—Simple tube drainage with Dakin irrigation, the large stiff rubber tubes being introduced by means of a trocar as above described, and carried below the level of fluid in a receptacle on the floor under the bed is usually curative in the empyemas of children. In one of our early cases healing occurred in one month from this treatment alone. As a rule it is not sufficient in adults.

5. *Exploratory Operations.*—Cases with persistent cavities and poorly draining sinuses are explored either through a long intercostal incision, with spreading of the ribs, or by costatectomy or thoracoplasty. By a simple rib spreader (Fig. 3), the ribs may be separated for six or seven centimeters, sufficient to introduce the hand and to explore the pleural cavity thoroughly. The ribs are held apart by a special rib prop (Fig 4). In many cases, especially in old dense walled cavities, it is more satisfactory to resect freely the ribs overlying the sinus or cavity. If necessary the lung is freed or decorticated. The wound is left freely open

pending sterilization by the Dakin method, or partially closed with a large valve-tube drain. It is especially important to remove bismuth paste which prevents the obliteration of cavities and is a cause of gingivitis and other toxic conditions, bits of necrotic bone, foreign bodies, to separate localizing partitions and to freely open all poorly draining pockets. These extensive operations are best carried out under properly administered gax-oxygen anesthesia.

6. *Secondary Closure* of large thoracic cavities left after operation for empyema has been successfully carried out by Tuffier by first sterilizing the cavity by the Carrel-Dakin method, then excising the wound margins and mobilizing the skin edges, which are united without drainage. The method converts the chest cavity into a pneumothorax, which is supposed to close spontaneously. Tuffier reports success in 16 out of 23 cases. In five of our cases one was successful, two partly successful, two failed. In none of our cases with a large cavity was the complete closure successful. Our present tendency is to unite the skin and underlying muscles, leaving an adequate drain.

7. *Pulmonary Fistulas* present special surgical problems. With a fistula communicating with a bronchus, irrigation or Dakin treatment cannot usually be employed. There may be a single opening, following a lung

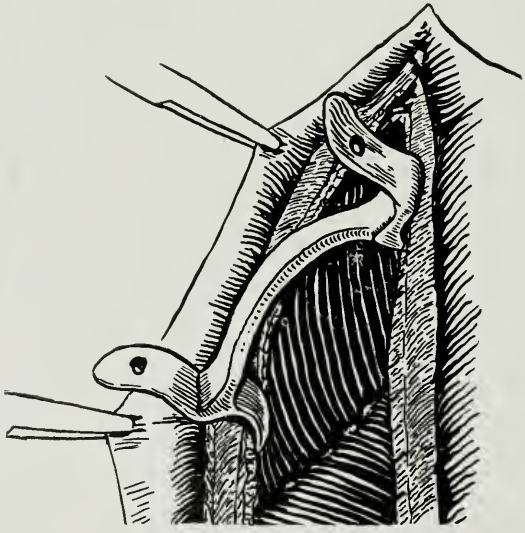

Fig. 4.—Simple rib prop for holding ribs apart in exploratory thoractomy.

abscess or area of necrosis, or the surface of the lung may be like a sieve from multiple small openings. Often the character of the external sinus does not reveal the form of fistula. Roentgen ray studies after bismuth

injection give much aid but involve the risk of filling the bronchi and alveoli with the insoluble paste. In most cases operative treatment is desired.

We have considered the following methods of closure:

(*a*) Suture of the opening with or without resection of a wedge-shaped portion of adjacent lung tissue.

(*b*) Occlusion of the opening by suturing the adjacent lung tissue to one edge of the deep wound in the chest wall. This may be immediately effective and permit the prompt resumption of irrigation of the empyema cavity.

(*c*) Plugging of the opening by suturing into it or over it a flap from the adjacent soft tissues. This may consist of mobilized parietal pleura, skin, or other soft tissue. A flap of muscle is usually preferred.

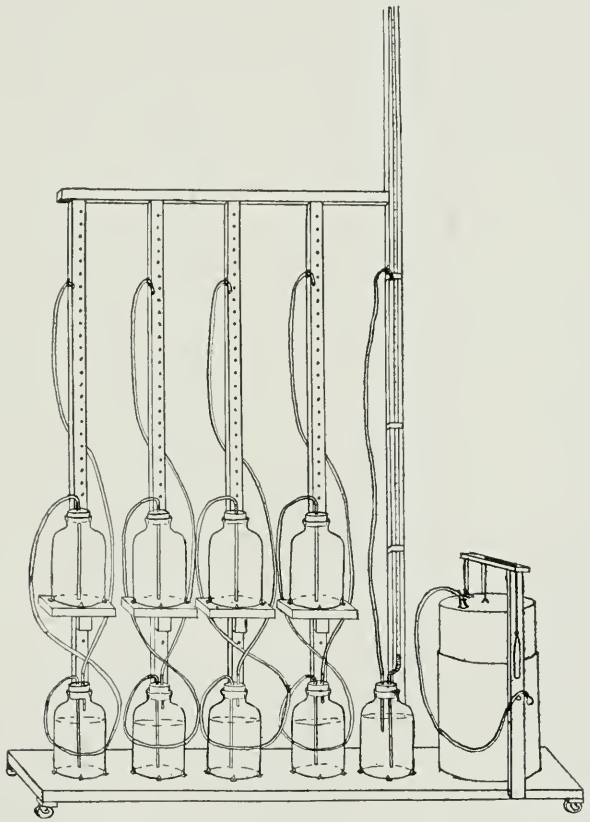

FIG. 5,—Improvised apparatus for graduated expiratory exercise. A simple manometer made of a bottle and glass tubing and a spirometer shown to the right.

(*d*) Closure of the opening by means of a purse-string suture, introduced about its margin.

(*e*) Apposition and adhesion between the surface of the lung and overlying chest wall obtained either by mobilizing the lung or by a thoracoplasty. Usually several ribs are resected and the lung is mobilized by freeing its edges and dividing adhesions. The wound is then closed except for a large valvular tube drain. We have seen extensive subcutaneous emphysema follow the lack of an air vent. In these cases the affected lung is distended during expiration and the air leakage occurs during this time. In the operation of pulmonary decortication, surface vesicles are often opened and it is possible multiple fistulæs may follow this operation. Usually, however, such damage to the cortex of the lung is rapidly repaired.

(*f*) *Delay.*—Many fistulas heal in time by a process of granulation after free opening and drainage of the empyema cavity. The last word has not yet been uttered as to the best treatment of pulmonary fistulæ.

Of great importance in the after treatment of empyema is proper exercise. Patients should be encouraged to be out of bed as soon as possible after operation, and special exercise should early be undertaken. We found the use of a simple improvised spirometer and manometer of value. The interest of the soldier is excited by the daily records made, and the figures give him an incentive to progress with the treatment. Competition and association are of great value in this work. By blowing definite quantities of water from a lower bottle to a higher one, patients may be made to do a graded amount of work daily and a progressive increase in the distending force of the exercise obtained. Fig. 5 shows a simple apparatus which may be used by four patients at one time. It has been found much easier to develop and maintain interest by such an apparatus than by the usual Wolfe bottles. The patient is also encouraged to increase his chest expansion by exercise while sitting in a chair with fixation of one side of the chest, and by selected calisthenic movements. Finally he is permitted to do the heavier forms of manual labor; farming and gardening having especial advantages in developing the chest and in aiding to determine as to whether or not the soldier is fit to resume military service.

THE TREATMENT OF DUODENAL ULCER

By G. REESE SATTERLEE, M.D.
New York

Before describing the treatment of duodenal ulcer, it seems advisable to give a brief outline of the diagnosis of these cases. We will deal principally with chronic ulcers.

Diagnosis.—Pain is the most constant symptom, and is usually localized

in the right hypochondrium. Referred pain is experienced in the epigastrium or intercostal regions. The occurrence of the pain is usually from two to six hours after eating, but it is sometimes constant. The pain is often intermittent, lasting for a month and then subsiding for a few weeks. The character of the pain is usually acute and spasmodic when the ulcer is situated near the pylorus, and there is a dull ache in the duodenal region during the interval. The patient is always conscious of "something wrong" in this region. Backache is also very frequent. There is usually soreness or tenderness localized in the right hypochondrium. The pain is often relieved by small amounts of food or alkalies and is increased by acids, acid foods, meat and large meals.

Digestive disturbances. Nausea during the attacks of pain, and sometimes vomiting, are present, and characterized by intermittency of symptoms. When the ulcer is actively bleeding, hematemesis and dark, bloody stools, or occult blood in the feces, occur. Only a few of the cases show these symptoms. Flatulence is nearly always present, but constipation is variable.

Toxemia. This form of toxemia seems to be peculiar to duodenal ulcer. It is different from the toxemia so common in lesions of the colon, and does not respond to the same remedies. It is due probably to a septic absorption from inflammatory exudate at the base of the ulcer, through the lymphatics, combined with the biochemical products from the duodenal epithelium, first noted in Draper's experimental work. The resulting symptoms are slight chilly sensations, brief rises in temperature, and mental depression. Small lesions in the sensitive duodenum give rise to severe general disturbances, as are evidenced by the disturbance following rough handling of this delicate organ at operations.

The coincidence of duodenal ulcer and appendicitis in the same patient is so very frequent that we cannot but pay attention to cause and effect in these two conditions. We might justly add to our list of symptoms those of chronic appendicitis. We must not only make our diagnosis very conservative, but we must also be very thorough at the time of operation.

When the ulcer is situated adjacent to the pylorus, pyloric stenosis, with its familiar train of symptoms, may result. This condition is nearly always of long duration, begins with the characteristic symptoms of duodenal ulcer, and then, as the pylorus becomes stenosed, the symptoms of a chronic dilated stomach appear. Very frequently no severe gastric symptoms are present, but emaciation is progressive. In severe cases there are marked epigastric distress and pain, gastric flatulence, hunger pains, and vomiting of large amounts of accumulated food, emaciation, and usually constipation. It is amazing, however, to see how much these patients will stand, and very frequently they do not consult a doctor until late in the disease. From the

findings in the cases that have come under my observation most of the ulcers causing pyloric stenosis have started orad to the pyloric sphincter.

Physical examination of patients with duodenal ulcer usually shows well-nourished individuals with no evidences of gastric dilatation. Tenderness is generally present in the right hypochondrium over the duodenum. Tender points are frequently found along the lower intercostal nerves and a localized area of tenderness in the tenth intercostal space to the right of the vertebra. In gastric ulcer, the area of tenderness is often to the left of the spine, but there is no inflexible rule. This involvement of the intercostal nerves can be explained by the connections of the celiac plexus of the sympathetic and the intercostal nerves. More frequently, however, the cause must be attributed to the effect of a general toxemia on the whole nervous system.

The facial expression is often quite characteristic. As a result of the long-continued pain and distress, the face has a drawn, anxious expression, with a deepening of the lateral furrows, deepened and darkened eye sockets, and a toxic duskiness of the skin. The tongue may be only slightly coated, unless there is an accompanying gastritis and intestinal toxemia.

The true diagnosis often cannot be made until the *x*-ray examination is made. The characteristic findings are filling defects, irregular outlines, residues in the duodenum, and spasms of the pylorus. Great care must be exercised in differentiating these spasms from reflex ones due to lesions in other parts of the gastrointestinal tract. Occasionally the *x*-ray findings are more positive than the inspection during laparotomy; as in case of W. H. P., reported in this paper. A small defect in the duodenal cap was noted in the plates and fluoroscope examination, both before and after operation. Search for a defect was made during laparotomy, but none found, and the spasm and pain in this region still persist, so that we can be reasonably certain about the diagnosis. Hyperperistalsis of the stomach and duodenum, with rapid motility, are strong contributing factors in diagnosis. The value of gastric test meals is often doubtful. Hyperchlorhydria is often present, but normal or subnormal acidity is about as frequent. Ingestion of dilute hydrochloric acid is of little value.

The duodenal tube should be used, and may be of distinct service in the diagnosis. Its value is twofold: (*a*) From the examination of the aspirated duodenal contents, showing, perhaps, pus and blood; and (*b*) as an aid in the visualization of the duodenum. In some instances, when the rapidity of the passage of the bismuth or barium does not permit of proper visualization, irregularities may be demonstrated with the tube in situ, and filled with barium. It must also be remembered that there may be apparent deformities in the duodenal cap during the first few minutes after the ingestion of the bismuth or barium meal, due to the early slow and imperfect passage of the stomach contents through the duodenum. This

mistake can be rectified by continuing the study for twenty minutes. Radiographs taken within the first ten minutes, and showing such defects, should always be interpreted cautiously. In one of our patients (M. G.), dilatation of the duodenum was the only finding, and operation revealed a large duodenal ulcer.

The string test is sometimes of value and simple, but the results are sometimes misleading, for it must be remembered that blood stains or blood are not always conclusive of ulceration. It is of value, however, as contributory evidence.

Treatment.—In order to treat duodenal ulcer intelligently it is necessary to bear in mind all the diagnostic points and the site of the lesion. It is fortunate that lesions in the duodenum are very rarely malignant, so that we can consider the process as benign.

The treament should be considered under two heads: (*a*) Palliative, and (*b*) curative. Palliative treatment may also be curative, although all these patients should be considered surgical risks. Medicine and surgery share equal responsibility. Those men who claim that the majority of duodenal ulcers can be cured by medical means have probably had a good run of luck, but the teaching is pernicious. On the other hand, operation may also fail of a cure. Syphilitic ulcers may respond to antisyphilitic treatment, but positive Wassermanns and presence of tuberculosis do not exclude operative measures. The essentials in medical treatment are: (*a*) Diet, (*b*) rest, (*c*) drugs, and (*d*) duodenal lavage and local measures. In order to obtain success with a diet it is necessary to combine it with rest in bed. Many modifications of the famous Lenhartz diet have been made, but the formulæ should be flexible, in order to suit the individual. The first ten days should have a rigid diet of milk, eggs, or egg albumen, with frequent feedings. After that the diet can be gradually increased, and then a list of foods which are well borne should be given the patient.

The author will omit the minute details of diet, as these are boresome. In general, the articles of diet which are usually well digested and non-irritating are: Milk, sweet or fermented; egg albumen, rennet, cooked fruit of the non-acid type, stale bread or toast, butter, cream, thoroughly cooked vegetables, especially the green ones, and the light cereals, particularly strained oatmeal gruel. The foods usually contraindicated are: All kinds of meat and fish, acid fruit and raw fruit, vinegar, spices, large amounts of sugar, the heavy, starchy vegetables, as potatoes, lima or baked beans. Articles containing large amounts of cellulose and bran are not contraindicated, and are very useful to combat constipation.

Drugs. Alkalies are always useful, and apparently necessary in many cases. Of these, bicarbonate of soda is the best, and the magnesia preparations next. Bismuth subnitrate combined with heavy magnesium carbonate, in varied sized doses, will give temporary relief in nearly every

instance. Hot water or milk, with bicarbonate of soda, is also extremely useful. The time to administer these alkalies is from two or four hours after meals and during the night. They should not be regarded as curative, but palliative only.

For the attacks of pain, some of the preparations of opium may be necessary to give relief; of these, tincture of opium and camphorated tincture of opium are the best. Morphine, hypodermatically, may be used when gastric irritability is too great, but is not as satisfactory as the opium preparations. Orthoform has a better effect on gastric than on duodenal ulcers; its usefulness in duodenal ulcers is of doubtful efficacy.

I have been using benzyl benzoate for the relief of pylorospasm and the consequent pain, with excellent result in one patient with duodenal ulcer. It has been recommended by Dr. David I. Macht of Baltimore, and said to be harmless as to habit formation. Complete relief was experienced by this patient in one-half to one hour, followed by a refreshing sleep. The relief was as pronounced as that from opium, but the effects two months later, according to the last reports, were not so good, and obtained only by larger doses. Operative measures will probably be necessary. Adrenalin hypodermatically has been reported on favorably by Dr. Charles G. Stockton, who obtained relief in four out of six cases. He used injections of 1 c.c. of a 1 to 1,000 adrenalin solution. As benzyl benzoate and adrenalin are supposed to have the same physiological action on smooth muscle, relieving spasm, their use should be logical.

Local application of cold or heat to the abdomen is of some value, and should be used.

The use of the duodenal tube. The duodenal tube is left in the stomach over night, and benzyl benzoate given if pylorospasm occurs. The following morning, on an empty stomach, the duodenum is washed out with plain hot water or soda solution. This is followed by instillations of silver nitrate, 100 c.c. of the strength of 1 to 20,000, up to 1 to 1,000, or 20 per cent. argyrol. The symptoms are relieved by this method, but care should be taken not to leave silver nitrate solution in the stomach, which should be aspirated before removal of the tube. The patient can follow up this treatment at home. In some patients, where the hydrochloric acid content of the gastric contents is deficient, administration of hydrochloric acid has given good results, demonstrating the fact that pain is not always caused by this acid. On the other hand, large amounts of alkali may interfere with digestion.

Accompanying enteroptosis, constipation, and intestinal stasis must always be properly cared for. A large number of these cases are mistaken for gastric or duodenal ulcer, as the symptomatology of a residual stomach is very similar to that of ulcer.

Duodenal ulcer should always be regarded seriously, as the danger of perforation is very great, and delay in operative procedures may be fatal. Dr. C. L. Gibson has well described the symptoms of perforation as "very sudden, sharp pain in the epigastrium, faintness, or even collapse, abdomen becoming boardlike, retracted, and exquisitely sensitive to the touch. Vomiting at the beginning may or may not occur, and vomiting of blood is very exceptional." Operative treatment and repair of the ulcer, with or without gastroenterostomy, is imperative.

There are a variety of opinions as to the advisability of operation in the chronic cases. As a rule, we find the medical man inclined to treat them medically and the surgeon surgically; that, perhaps, is natural, as we all do that in which we are most proficient. It is to the internist, however, that we must appeal for advice, and he must be unbiased. Our opinion must be formed only after close observation of our operative and non-operative cases.

Of thirteen operations performed by Dr. J. W. Draper (personal communication), ten gave uniformly good results. First, in regard to the failures: Dr. Draper states that in the first place this operation has often been done either when no operation at all has been indicated, or when extensive resection of the right colon, developmental reconstruction, should have been done in its place. Again, the indications for the operation may have been clear, but the technique of its performance has been faulty. There is no way open for the practical elucidation of these problems equal to that of careful clinical observations on postoperative cases. Draper, in this study of thirteen cases, finds that two—in which he and Lynch subsequently performed the operation of developmental reconstruction of the colon—had undergone gastroenterostomy nine and twelve years respectively prior to the colonic resection. There had been, naturally, no improvement, but rather a clinical impairment, since the cases had not been suitable ones for gastroenterostomy, and this in spite of the fact that in each case, after *this lapse of years the stoma was found to be open and functionating.* The removal of a severely infected ceco-colon, in which, because of impaired epithelium, there were large amounts of subepithelial pigment, promptly cured these cases. These are striking examples of the need of careful preoperative study, so that such disastrous surgical errors in diagnosis may be avoided. In one case, the ulceration extended orad to the pyloric vein, and necessitated, therefore a pylorectomy. Cancer cells were found in the overhanging margins of this ulcer, and as the gastroenterostomy following resection has functionated well, it was probably the operation of choice.

The remaining ten cases have given uniformly good results because they were done for more or less extensive duodenal ulceration, which had persistently refused to heal under modern medical treatment. The incidence of accompanying appendicitis is very large, no less than 90 per cent. in this

series; five, or 50 per cent., had undergone simple appendectomy at least one year prior to the gastroenterostomy. The relation between cause and effect here is very significant.

One in which a pyloric resection was done required four operations before final cure, two successful stomata being established, only to be obliterated by inflammatory tissue. This patient has gained sixty pounds since the last operation, fourteen months ago. Competent men considered this case carcinoma, because of the massive glandular enlargement. All this has disappeared since the last operation.

Draper regards it as essential that Hartmann's advice be followed regarding the position of the stoma as close as possible to the pylorus, and at a point where the stomach can be cut directly across from the greater to the lesser curvature. His experimental studies upon animals corroborate his clinical findings as to the very great importance of this technical point.

I should like to quote in detail the case history of a typical small duodenal ulcer which showed definite *x*-ray findings, but could not be located at operation. It is also a good illustration of what medical treatment can accomplish.

W. H. P., male, 50 years, druggist. Patient was formerly a rapid and heavy eater and did not masticate properly. He was first seen six years ago, when he had complained for a year and a half of flatulence and eructations, the symptoms being worse at night. He had to sit up in bed with pain in the stomach and intestine; the pain was also worse when working so that he had given up business. The bowels had been irregular for six months and he had been taking a purgative water and sodium sulphate regularly. The stools were constipated, whitish for a while, and covered with mucus. There had been loss of weight. At that time gastric analysis showed free HCl 37, combined HCl 17.75, organic acid and acid salts 45.25, no blood, no lactic acid. Radiographs showed normal stomach and intestinal stasis. Stools showed blood-streaked mucus, and the diagnosis was chronic colitis and constipation. He went to work on a farm and gained fifteen pounds. An abdominal belt for enteroptosis had also helped him. The pain continued, however, and one year later there was tenderness over the appendix.

Six months later he complained of pain starting in the right hypochondrium and traveling to the left side, lasting for eight hours and relieved by opium, ten minims of laudanum or ¾ grain of codeine. The pain would occur at night or early morning. No diarrhea, constipation nor mucus. The cecum crepitates. Colon irrigations were made.

Eight months later, January. 1917, there was a tender spot in the region of the gall-bladder and the pain in the upper abdomen still necessitated opium. String test was negative. He had attacks of food retention in the stomach. Orthoform relieved at times, but not nearly so effective as opium. Gastric contents showed free HCl 10, combined HCl 12, organic acid and acid salts 11, and total acidity 33.

In February, the next month, he had two bad attacks lasting twelve hours with food residues. I saw the patient at midnight, when he showed distinct pain, tenderness over McBurney's point, and right rectus rigidity. Gastric contents then showed free HCl 53, combined HCl 8, organic acid and acid salts 14, and total acidity 75.

Careful studies of gastric radiographs at this time showed a slight filling defect in the first portion of the duodenum, close to the pylorus. Stasis, no ileal delay, no outline of appendix and no gallstones.

Dr. J. M. Lynch operated February 16, 1917. Appendix was very long, fibrous and bound at tip to terminal ileum. The proximal portion was dilated and acutely congested. The ascending colon was adherent by partial elbow adhesions to the liver. The adhesions were cut and the appendix removed. Gall-bladder, stomach and duodenum were normal, especial care being taken in examination, as duodenal ulcer was suspected. Constipation became severe after operation and there was a nephritis which cleared up. This decided us to be cautious about any further operation. Two months after the operation the patient was in excellent condition and had no pain.

One year later, February, 1918, patient had gained 19 pounds, but pain had returned last September with his old complaint of "formation of gases." Again he had to resort to opium and lost weight. The character of the pain was about the same as before and from two to three hours' duration. He had a tight sphincter ani and congested, dusky rectal and sigmoid mucosa. He had one slight attack of obstipation. Gastric contents showed free HCl 34, combined HCl 00, organic acids and acid salts 19, total acidity 43, bile present, lactic acid absent. Fluoroscope showed small active stomach, nearly empty in one hour. Pylorospasm was also demonstrated as seen in the lantern slides and also a small filling defect in the first portion of the duodenum. Tenderness in the duodenal region. He is taking small amounts of alkalies.

The duodenal tube was inserted over night, and the duodenal contents showed no blood, occult or otherwise. Duodenal lavage with hot soda solution.

This was followed by four days free from pain, the longest interval since September, 1917. The duodenal tube was inserted once or twice a week with lavage, followed by 100 c.c. of silver nitrate solution, beginning with 1 to 1000, which was left in, care being taken to aspirate any of the solution left in the stomach. The severity of the pain was gradually lessened, the intervals between attacks lengthened, with marked improvement in six weeks. The diet consisted of three eggs, milk one quart, strained oatmeal, cream, six slices of bread, stewed prunes and postum. Patient was not confined to bed, but rested and went to bed early. For the attacks of pain, benzyl benzoate in the following formula, as recommended by Dr. David I. Macht of Baltimore, was given: Benzyl benzoate 20 mils, alcohol 95 per cent. 80 mils, oil of peppermint 2 mils. Sig. Twenty drops in cold water once or twice a day. Relief from the pain and spasm was experienced in ¾ hour and complete in one hour. The diet was increased by the addition of arrowroot and tapioca. The patient stated that the relief from the benzyl benzoate was as complete as that from opium without disagreeable after-effects. The patient then went home and reported that the pains had recurred with some severe ones which were not relieved by the benzyl benzoate.

For two months the patient has been practising duodenal lavage every two days, and leaving in ½ ounce of 20 per cent. argyrol solution. The tube now enters the duodenum within an hour.

He was seen on May 31. The tenderness over the duodenum had disappeared and for one month there had been no pylorospasm attacks, the pains complained of being due to constipation and colon spasm, caused probably by the constipating diet and flatulence. A more laxative diet was substituted, with bran, green vegetables, nuts, etc., and the duodenal lavage was continued. He has improved very much.

Conclusions.—1. Duodenal ulcer needs a careful differential diagnosis from gastric ulcer, as the prognosis and treatment are distinctly different from those in the latter.

2. The treatment of duodenal ulcer is usually medical and surgical; neither side should be neglected.

3. Under medical treatment, rest, and duodenal lavage and medication should be tried.

4. Operation is indicated in severe cases.

5. No-loop gastroenterostomy, after the method of Hartmann, should be done where possible.

6. The operation of gastroenterostomy may be useless if diseased conditions in the right iliac fossa are not rectified by removal of adhesions, kinks, ceco-colon, etc.

7. In all operations for chronic appendicitis the right hypochondrium should be carefully inspected for evidence of duodenal ulcer, as the two conditions are closely associated.

8. Expert radiography, with fluoroscopy of the gastric and duodenal region, are essential, and sometimes of more value in diagnosis than simple inspection at operation.

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TREATMENT OF INTESTINAL STASIS BY DUODENAL LAVAGE

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The torrent of literature which has been poured out in recent years on the seemingly interminable subject of intestinal stasis is so vast and contradictory as fairly to bewilder the conscientious reviewer. While we all know what intestinal stasis is, as a profession we disagree about practically everything but the definition. In the pathological picture which the term involves, what is cause and what effect? It is a vicious circle, with a vengeance. A veritable legion of ailments is associated with the center of contemplation—the torpid bowel. Is the bowel the real culprit, or is it the goat? While one group of writers believes that a wrong and ill-assimilated diet is the principal cause of the stasis, leading in turn to numerous other complaints, another group holds the opposite view, and blames some anomaly of intestinal position for the malassimilation of the food and the consequent gamut of pathological possibilities. The proposed treatments differ, as a matter of

course, as widely as the etiological views. While some would confine the treatment to medication, pure and simple, except when surgery is unmistakably indicated, others incline to the Biblical injunction to remove the offending member, and, on the assumption that even remote skin diseases are directly or indirectly due to intestinal kinks, membranes, adhesions, and bands, would fain anastomose the ileum with the sigmoid for the purpose of growing hair on a devitalized scalp.

While the experienced physician—who treats each case on its merits, instead of resorting to routine measures—finds intestinal stasis, with its associated pathological conditions, fairly amenable to indicated remedies, the fact remains that he must be content with having alleviated individual distress in a given case without having been able to solve the general question.

The addition of yet another method of treatment may therefore be viewed from two different angles: it may be considered a step in the wrong direction by those who flatter themselves that their own pet methods meet all the requirements, or it may be hailed with delight by those who have convinced themselves of the fatuity of medical and surgical endeavor in a large number of intractable cases.

The title of this paper indicates that the new method to which I refer is duodenal lavage.

This method of treatment has several advantages, even in the improbable event of its not effecting the object intended: it is harmless, it does not mutilate or injure the anatomy, it will not in curing one pathological condition bring about another worse than the original; it will have a beneficial effect upon the intestine even if, in obstinate cases, which have yet to be determined, it should fail of its whole purpose. It is not the outcome of a fine-spun theory but the result of sober reflection, practical experience, and repeated application. The treatment may be given in the office, does not require detention at the hospital, and does not interfere with the daily occupation of the patient.

In cases of intestinal stasis associated with an obstruction, such as kinks, bands, and adhesions, I have found that clearing out the whole of the intestine from above the obstruction will give the bowel an opportunity to recover tonicity sufficient to overcome effectually the stasis. If there happen to be adhesions, compensation takes place in some way or other, and recovery is the result. The kink may remain the same, but the patient recovers his health, which, after all, is the practical object of any treatment in any condition. As long as normal motility is not interfered with there is absolutely no indication for surgical intervention. Lavage restores normal physiology, and if they are right who assert that the duodenum excretes a poison which is responsible for a great deal of the toxemia from which the human race suffers, then

lavage, according to the method I am about to describe, is the remedy to remove the poison.

The immediate result in all of the cases I have so far treated, or which are still under treatment by this method, has been uniformly good, and the details of the clinical histories are therefore unimportant for the purposes of the present paper. I admit that all are recent cases, and that I cannot speak of end results until after a lapse of years; but in view of the fact that the immediate results have far exceeded all expectations, that, so far, no relapses have occurred, and that even in the event of a relapse no harm whatever is done and the treatment can be repeated, the patient having meantime enjoyed a long interval of good health, I consider myself warranted in strongly urging the adoption of duodenal lavage in all appropriate cases. I am convinced from the results obtained that in the majority of cases of intestinal stasis, duodenal lavage, as practised by me, will do all that surgery can do, and do it better, since it does not entail a train of possible deformities and their consequences.

The technique I have worked out and adopted is as follows:

While any of the many duodenal tubes can be employed, the instrument I now use is the duodenal tube of Jutte. The tube measures only one-sixteenth of an inch in external diameter, and is provided at the lower end with a small olive-shaped lead sinker, with perforations in the tube above. With a little practice the tube can be easily manipulated to insure its arrival at the pylorus, whence it is carried by peristalsis into the duodenum, with the patient lying on his right side. The pylorus should be patulous, and it is necessary, therefore, to undertake the proceedings on an empty stomach. By any of several well-known tests we can ascertain whether the sinker has arrived in the duodenum, and as soon as it has lavage may be begun.

Since Jutte's object in using his tube is the cure of a variety of ailments, he varies the composition of his solution accordingly, but I have found that for the treatment of intestinal stasis in general the best solution is 30 grams of magnesium sulphate and 60 grams of sodium sulphate in a liter of water. The lavage is given daily for ten days, as a first series of applications; then, on alternate days, for another ten days: and the third series follows at intervals of three days, the number of treatments given in this last series being only three or four. Although by this time success is fairly certain, I have made it a practice to continue with one lavage a week until recovery is fully established. There are no unpleasant by-effects, and patients will tolerate the treatment for any length of time without discomfort.

There has not been a single failure in any of my cases in regard to the clinical cure of intestinal stasis, and incidentally also of constipa-

tion, although the anatomical conditions of kinks and adhesions remain unchanged. From this positive fact several obvious conclusions may be drawn. The first is that kinks and bands—which, indeed, have been pronounced physiological by some authors—are not necessarily the cause of intestinal stasis, and that, consequently, their surgical removal will not cure the stasis. Another conclusion is that any other pathological condition—rheumatoid arthritis, gout, functional disorders of the heart, arteriosclerosis, epilepsy, asthma, cirrhosis of the liver, primary and secondary anemia, skin diseases, catarrhal inflammation of the mucous membranes, eye diseases, neuralgia, neuritis, insomnia, neurasthenia, melancholia, dementia, and insanity—should disappear after successful duodenal lavage treatment, if these conditions are really caused by intestinal stasis; and if they do not disappear after the supposed causative factor has been removed, it follows that the etiology requires correction—that these conditions were not, after all, due to intestinal stasis.

How far and in what way these conclusions will be supported by the final results of duodenal lavage, adopted on a wide scale, it is too early to state. Inasmuch as the intended clinical results, the removal of inestinal stasis, is fully assured by this method, its general adoption is to be hoped for, so that the combined observations of the profession in regard to incidental results in the improvement of other pathological conditions may be used as a basis for formulating a therapy for affections which have hitherto been more or less obscure.

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THE MODERN TREATMENT OF GALLSTONE DISEASE AS AFFECTED AND CONTROLLED BY DUODENAL INTUBATION

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Relative Frequency of Gallstones.—There must be great variations in the relative frequency of the occurrence of gallstones among different nations, and these variations depend upon the method used in ascertaining their existence, whether by simple clinical investigation, by operation, or by autopsy. One need only look over the alphabetical index of the *Journal of the American Medical Association* or that of the *Medical Record* to be astonished at the large number of contributions to this subject, and also at the varying figures given concerning the frequent

occurrence of this disease. Barker, in his splendid new work on the "Clinical Diagnosis of Internal Diseases," states that the percentage of human beings found to have gallstones at autopsy is five to ten. This may serve as an American estimate. Scheel, in *Ugeskrift for Laeger,* November 30, 1911, gives 15 per cent., based on 2,753 autopsies. Pel, in his "Krankheiten der Leber und der Gallenwege," page 312, quotes Halk as finding gallstones in 29 per cent. of all autopsies, and he himself, in his observations on the autopsies on old women performed in Amsterdam, found 20 per cent. of cases of gallstones in cases which had given no symptoms during lifetime. It should be added that Halk's material was composed of individuals over fifty years of age. In the article by Quincke and Hoppe-Seyler in "Nothnagel's Specielle Pathologie n. Therapie," the relative frequency of the finding of gallstones by twelve European pathologists varies from 2.4 per cent. to 29 per cent. The largest autopsy material is that of Poulsen, in Copenhagen, who gives 91,722 sections with 347 findings of gallstones, making 3.7* per cent., but Poulson states that only 9 per cent. of this material showed any symptoms during life.

Three things influence the figures obtained at autopsy. First, the experience, punctiliousness and carefulness of the pathologist; secondly, the age of the patient; and thirdly, the sex. Peters, at Kiel, found that in persons under thirty years of age the percentage of cases of gallstones was 0.62 per cent.; between thirty and forty years, 3.24 per cent.; between forty and fifty years, 4.44 per cent.; between fifty and sixty years, 6.98 per cent.; between sixty and seventy years, 9.53 per cent.; between seventy and eighty years, 13.02 per cent.; and over eighty years, 16.36 per cent. The figures given by Rother of Munich are one to thirty years, 3 per cent.; thirty-one to sixty years, 6.9 per cent.; sixty-one and over, 19.2 per cent. Schroder of Strassburg gives the following figures: Under twenty years of age, 2.4 per cent.; twenty-one to thirty years, 3.2 per cent.; thirty-one to forty years, 11.5 per cent.; forty-one to fifty years, 11.1 per cent.; fifty-one to sixty years, 9.9 per cent.: sixty and over, 25.2 per cent.

Etiology.†—A perusal of the American publications evidences a unanimity of opinion that in the United States women are affected between three and four times as often as men, and this proportion between

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*In the above statistics by Poulson an arithmetical error must have sneaked in, for 347 does not constitute 3.7 per cent. of 91,722. I calculate that to obtain this per cent. he must have had 3,393 cases of gallstones at autopsy.

†For the History of the Clinical Recognition of Cholelithiasis, see J. C. Hemmeter in Sajous' Analytic Cyclopedia of Practical Medicine, Seventh Edition. Vol. III, p. 275-276. Also Die Krankheiten der Leber, by Quincke and G. Hoppe-Seyler, in Nothnagel's Specielle Pathologie und Therapie, Band 18, p. 180-188.

males and females appertains at all ages. The same is true of French and German statistics. Reinelt found in subjects between the ages of fifteen and thirty years gallstones in 1.3 per cent. of the men and 3.8 per cent. of the women. From thirty-one to sixty years the figures were 6.4 per cent. for men and 14 per cent. for women, while for over sixty-one years the figures were 17.9 per cent. for men and 25.4 per cent. for women. For the years from 1901 to 1906, 386 operations were performed for gallstones at the Heidelberg clinic; of these, 46 were men and 340 were women; in other words, there were seven times more women than men. This difference is attributed to the sedentary habits of women, influence of tight lacing, repeated pregnancies, and puerperal infection. These etiological factors must have consideration in the treatment.

In speaking of the direct etiology we must consider everything which could produce stagnation of the bile flow. Among these we must consider compressing clothing, insufficient bodily exercise, dislocation or compression of the bile ducts by tumors or cicatrices. Among the causes which are little recognized I wish to call attention to one of which I have convinced myself repeatedly at autopsies; that is, enteroptosis, and gastroptosis especially. The displacement of the stomach may cause traction upon the hepatoduodenal ligament. This I have frequently seen at abdominal sections undertaken for gallstone. Another cause is dislocated or floating kidney. Then there seems to me to be a form of atony of the musculature of the gall bladder, which in some way is produced by the traction caused by dislocated abdominal viscera in enteroptosis. The tugging upon the splanchnic and abdominal branches of the vagus interferes with the reciprocal innervation that exists between the sphincter at the papilla of Vater and the musculature of the gall-bladder. A close relationship seems also to exist between gallstone disease and pancreatitis.

As the successful treatment must be based on a knowledge of etiology, we must repeat the statement of Naunyn that two conditions are necessary for the formation of gallstones: First, stagnation of the bile flow; and secondly, bacterial infection. Up to the present time this is still acknowledged to be a clinical axiom, and was first pointed out by Naunyn in 1892 in the "Klinik der Cholelithiasis," a brilliant classic on this subject. Throughout the many volumes of *Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie* this eminent clinical philosopher has given us the benefit of his broad experience and conservative critical judgment. According to him, the modern era of cholelithiasis begins in 1892. The significant progress of surgical technique in this period is especially noticeable in the American literature on the subject, and this is so great, and comes from so many able operators and surgical writers in the United States, that I deem it inexpedient to cite their

experiences in an article that is to be limited to the purely medical treatment of this condition. But I cannot pass over stating one impression that I gain from American surgical literature, namely, that the so-called early operations have in general been given up, and that the special field for the surgeon is the chronically recurring cholelithiasis. Especial indications for operation are: First, the infectious cholecystitis; and secondly, chronic obstructions of the biliary ducts.

In my articles already quoted I have dwelt on the chemistry of cholelithiasis. The stones consist of cholesterin, calcium, and pigment. The calcium occurs in the form of bulirubin-calcium, calcium carbonate, and calcium phosphate. Bulirubin calcium and the inorganic calcium salts are insoluble in the bile, but as normal bile never contains so much cholesterin that it could not dissolve still larger amounts it is probable that cholesterin stones can be dissolved to a considerable extent in human bile. Cholesterin is kept in solution by the bile salts and the precipitation of cholesterin from bile may be produced by withdrawal of these salts.

A remarkable difference of opinion exists between clinicians and physiologists concerning the derivation of cholesterin. Naunyn is of the opinion that the mucosa of the gall-bladder furnishes the cholesterin as well as the calcium of the gallstones, and thereby furnishes an explanation of the local origin of the gallstones in the gall-bladder. Physiologists, however, know that cholesterin is not formed by the gall-bladder or the liver, but is very widely distributed throughout the body, and that it is only eliminated by the liver cells from the blood, which collects it from the various tissues of the body. Cholesterin is a constant constituent of the blood. That it is an excretion is illustrated by the fact that it is eliminated in the feces, but the contrary view has been suggested, also, namely, that the cholesterin is in part reabsorbed and used again in the formation of new tissues. It is insoluble in water and dilute saline liquids. In the bile it is held in solution by salts of the bile acids. I wish to add in explanation of Naunyn's view that the cholesterin is formed by the mucosa of the gall-bladder, that this has reference only to the inflamed gall-bladder. It is, therefore, a pathological production of cholesterin that he has reference to.

Numerous other American as well as foreign authors have investigated the production of gallstones by the intermediation of bacteria. Most of them show conclusively that the presence of bacteria increases and accelerates the precipitation of cholesterin. Heyrovesky and Exner succeeded in producing a decomposition of the bile salts by the addition of the typhoid bacillus and the colon bacillus. By this the cholesterin was also precipitated, because it is held in solution by the bile salts. Kramer succeeded in producing precipitation of cholesterin by inoculat-

ing animals with the typhoid and the colon bacillus, contained in tubes of bile bouillon cultures. Heyrovesky had arranged a scale of bacteria, graded according to the intensity and quickness of their effects. The organism which acts most promptly and most intensely, according to this investigator, is the typhoid bacillus. The next in order is the colon bacillus, and the weakest in their effects are the pyogenic cocci, streptococci and staphylococci. His conclusion that the latter cocci could not be the primary and immediate infective agents in the formation of gallstones, but are by him supposed to be causative of the secondary or hematogenous infection of the gall-bladder, is not confirmed by American investigation, particularly by those of Rosenow.

About one-fourth to one-third of the total dry mass of the feces consists of bacteria. That amounts to 4.5 to 5.3 grams in twenty-four hours. The character of food, though it may influence the variety of bacteria, has no influence on the quantity. According to Weinert, sour milk is capable of reducing the amount of the bacteria to about one-half that above quoted.

Meconium of new-born infants is sterile. After the first breast milk is swallowed we find *Bacillus bifidus* of Tissier and *B. acidophilus.* A diet of cow's milk gives rise to *B. coli communis* and *B. lactoaerogenes* (a few streptococci); on a meat diet there are *B. coli gracilis, B. lacto communis,* yeast, *Sarcinae,* and *B. acidi butyric, B. subtilis.* According to Metchnikoff, the principal putrefactive bacteria are *B. putrefaciens sporogenes, B. welchii,* Oppler-Boas bacilli, and the bacillus of Hauser-Bienstock.

In considering the relative importance of the factors of stagnation and bacterial infection in the pathogenesis of gallstones, two perspectives must be held in mind: First, the factor productive of the precipitation either of cholesterin or of bilirubin calcium; secondly, the particular species of microorganism and its derivation. Among the normal bacterial inhabitants of the intestines above mentioned only the streptococci, *B. coli,* and the *B. welchii* come into consideration. Among the abnormal microbic invaders of the digestive canal we must consider the typhoid bacillus, staphylococci, pneumococci, and the tubercle bacillus. Mieczkowski found in twenty-three cases of cholelithiasis *B. coli* eighteen times, either in pure culture or mixed with straphylococci and streptococci. Chiari, in twenty-two cases of typhoid fever, found the typhoid bacillus in the gall-bladder nineteen times. The injection of a culture of typhoid bacilli without ligating the common gall duct, produced no infection. These experiments therefore demonstrate the necessary cooperation of the stagnation of the bile. In thirty-two cases of cholelithiasis, Létienne found the following bacterial infections: *B. coli communis*

eleven times, staphylococci seventeen times, streptococci twice, pneumococci, once, tubercle bacillus once.

That a progressive, infectious inflammation of the wall of the gall-bladder and of the bile ducts is necessary for the development of stones has been demonstrated by the experiments of Mignot ("L'Origine Microbienne Des Calculs Biliare," *Archives Generales de Medecine,* Aôut, 1898). The same experiments emphasize the factor of stagnation. Mignot filled the gall-bladder of rabbits and guinea pigs with sterilized cotton or gauze into which he brought a drop of attenuated culture of a virulent colon bacillus or staphylococcus. He then sewed the bladders shut with catgut. Three weeks later the bladders were again opened. They had now become thick-walled and rigid. A thread 2 centimeters long was passed through the wall of the larger end of the gall-bladder so that it remained freely suspended in the lumen. The wound was sewed up a second time. Six months later hard stratified stones, consisting exclusively of cholesterin, were found in more than one-third of the cases in the biliary passages of these animals.

If these special bacteria were introduced simply on silk threads or sand grains, and thereby a more or less intense cholecystitis was created, a precipitation of the bile was produced, but the process did not lead to stone formation.

Next to bacterial infection, therefore, the most essential causative agent is a paresis of the musculature of the gall-bladder and bile passages, or some form of obstruction.

In the various surgical procedures that have been employed for the cure of this disease surgeons have had in view almost exclusively the question of infection and the bacterial causes. When a cholecystectomy is performed this is the exclusive view that the operator has in mind, but another and equally important element demands consideration, if the views of Naunyn and Frerichs are correct. The former held that the cholesterin was derived from the epithelial cells of the gall-bladder and Frerichs assumed that the calcium to which the bilirubin and the fatty acids are generally bound is not derived originally from the bile but is a product of the mucosa of the bladder. If these statements were correct, the removal of the gall-bladder would not only be urgently necessary to remove the bacterial etiology and prevent the source of infection but at the same time to obviate the recurrence of deposition of calcium salts and cholesterin.

The percentage contents of human bile in calcium phosphate is 1.7 (Jacobsen) and in fresh dog bile Hoppe found 0.04 per cent. of phosphate of calcium and 0.03 per cent. of carbonate of calcium. Therefore, the percentage contents in calcium salts found in normal bile would be sufficient for the formation of stones without drawing in a hypothetical

calcium and gallstone secretion by the gall-bladder. Cholesterin and bilirubin calcium are both soluble in sodium glycocholate and also in alkaline liquids. Whenever the bile becomes acid in consequence of long stagnation, or abnormal secretion of gall-bladder mucous, then the sodium glycocholate is split up into its constituents, namely, glycocol, cholalic acid, water and a sodium salt. The consequence is that bilirubin is precipitated as a calcium salt and then cholesterin, and eventually also sodium taurocholate. These processes can occur under the abnormal condition of stagnation.

A. Dochmann (Theorie der Gallenstein Bildung, 1889), *Vratch*, No. 3. Abstracted from Maly, Jahresbericht, Band 20, p. 271) analyzed the liver bile and the gall-bladder bile separately. The bile in the bladder was drawn after ligation of the cystic duct. In these separate analytic determinations he found considerable difference between the two samples. In the bladder bile, the sodium was reduced and the potassium increased, as compared to the bile drawn from the hepatic bile duct. Now, the increased content of calcium reduces the solubility of the bilirubin and thereby leads to the precipitation of bilirubin calcium and of cholesterin.

In this controversy between those who hold that precipitation of bilirubin calcium and cholesterin from the bile as it comes from the hepatic duct is possible and those that hold that the epithelium of the gall-bladder secretes these substances, a more recent pathological and chemical study is of interest. I refer to the work of Achoff and Bacmeister (Die Cholelithiasis, Jena, 1909). These investigators believe that in most cases of inflammatory cholelithiasis there has been a non-inflammatory stage which preceded. They also set up the principle of different chemical origin of the different varieties of gallstones. They claim that the radiated cholesterin stone is formed singly and exclusively as a consequence of bile stagnation and without the co-operation of bacteria, but the cholesterin-pigment-calcium stone and the stratified cholesterin-calcium stone, as well as the pigment-calcium stone, are of inflammatory origin. These conclusions are based upon the following consideration:

The structure of the radiated stone is purely crystalline. From a center of crystallization rods of unequal length radiate in all directions toward the periphery. These cause the uneven surface of the stone, which is very porous, contains an albuminous skeleton structure and very little calcium. This stone is found only in gall-bladders that are not inflamed, simply in a state of stagnation. The morphology of this stone is indicative of a very slow process of deposition of its contents by crystallization from the bile. Its chemical composition corresponds to the composition of the normal bile, not of the bile changed by inflammatory processes. It is this type of gallstone that can be produced from

the normal bile without infection by simple chemical decomposition. The radiated cholesterin stone occurs almost exclusively as a solitary stone.

Bacmeister experimentally proved that precipitation of crystalline cholesterin from stagnated bile could take place in the entire absence of bacteria or albumin. It is true this precipitation could be augmented by the addition of sterile epithelial cells. In these observations he found the proof that the cholesterin does precipitate from simply stagnated bile, not by infection but by sterile autochthonous decomposition of the bile itself, in which, of course, the protoplasmic elements participate.

The material for the formation of the solitary cholesterin stone crystallizes out of the sterile bile. The process is augmented by the scaling off of the epithelial cells of the gall-bladder. By accurate investigations of gall-bladders extirpated by operations or found at autopsy, they came to the same conclusion, namely, that when a single cholesterin stone was present, every sign of inflammation of the gall-bladder was missing and only the evidence of gall-bladder stagnation was found. In order to arrive at this conclusion, it was necessary to study minutely the anatomy and histology of the gall-bladder, of which they give an admirable description. The distribution of the blood and lymph capillaries in the gall-bladder and bile-ducts is minutely described. They assign to the epithelium of the gall-bladder a twofold function: First, secretion of a pseudo-mucous substance (nucleo-albumin (?).) The beaker cells secrete pure mucin. Secondly, the absorption of fat and pigment.

Naunyn and Fink had claimed that gallstones could be formed from myelin, secreted by the epithelium of the gall-bladder. This Achoff and Bacmeister deny.

In connection with the possibility of the recurrence of gallstones, after so-called cures, Aschoff and Bacmeister call attention to the fact that the mucous glands, while they occur normally only in the neck of the gall-bladder and in the cystic duct, proliferate and extend throughout the entire gall-bladder and into the walls of Luschka's duct after inflammatory irritation. These ducts of Luschka extend into the musculature and fibrous tunic. The normal structure of the gall-bladder undergoes certain changes in chronic cases of bile-stagnation. The normal folds are effaced. The muscularis is hyertrophied. A diffuse small-celled infiltration takes place, as a consequence of the increased resorptive processes. Especially the fat absorption is increased in a stagnated gall-bladder. This leads to a dilatation of the subepithelial lymph capillaries. In consequence of this stagnation and the increased internal pressure Luschka's ducts are dilated and often filled with a detritus of a bile-stained mass. On the base of this altered and stagnating gall-bladder the solitary radiated cholesterin stone is formed.

The formation of inflammatory gallstones is entirely different from

this. The gallstones which are due to inflammatory conditions of the gall-bladder are the following: (1) Combination stones, showing interiorly the primary radiation of the cholesterin stone and exteriorly a stratified mantle rich in calcium. (2) The stratified cholesterin-calcium stones. (3) The cholesterin-pigment-calcium stones. (4) The larger oval barrel, or cylinder-shaped stones. (5) The common multiple facetted or mulberry-shaped stone. (6) The bilirubin-calcium stones.

Sometimes one can distinguish several cholelithic generations. It is sometimes also possible to trace different clinical pictures in the precedent history of gallstone disease in connection with these differently shaped stones. The markedly crystalline and relatively calcium-poor stones grow slowly and occur as solitary stones. Those stones that are rich in calcium grow rapidly and are generally found in larger numbers. Aschoff and Bacmeister assert that in the majority of all cases of cholelithiasis a non-inflammatory process precedes, and that definite relations exist between the different stone formations and the various diseased conditions of the gall-bladder.

As long ago as April, 1895, when I gave a demonstration of the first method for duodenal intubation practicable upon the human subject (Johns Hopkins Hospital Bulletin, April, 1895), I expressed the hope that the method might be available for the diagnosis of gallstones from the chemical and physical conditions found in the duodenal contents. (See also Hemmeter, Diseases of the Intestines, Vol. I, pp. 263-272; also Versuche uber Intubation des Duodenums, *Archiv. für Verdauungs-Krankheiten,* Band 2, S. 98, 1896, and Band 17, S. 136, 1911.)

This was long before any one else had ever conceived of the possibility of duodenal intubation.

When one considers, however, the widely different chemical composition of these various gallstones and the different clinical history of each as above alluded to, one must be at once impressed with the difficulty of this kind of clinical research. If we are to determine from the bile aspirated from the duodenum not only whether there are gallstones present, but their kind and the condition of the biliary apparatus, we should have reason to expect a different composition of the bile for each chemical type of gallstone. If in one case the stone is built up from the cholesterin of the bile, and in another case from the calcium, and in a third case from the bilirubin and calcium, it must be evident that we can expect no uniform and constant change in the bile that flows out into the duodenum under these conditions. This conclusion has been confirmed by my investigations, for all of my efforts to establish a constant chemical factor in the duodenal contents, and these efforts extend off and on throughout the last twenty years, have led to no definite chemical diagnostic factor discoverable in the bile as aspirated from the duodenum in cholelithiasis.

In an article entitled "Direct Examination of the Duodenal Contents (also Bile) as an Aid in the Diagnosis of Gall-Bladder and Pancreatic Affections" (*Amer. Jour. of the Medical Sciences,* CXLVIII, pp. 490-495, 1914), Einhorn states that the microscopic appearance of the bile is of great diagnostic importance. If it is golden-yellow and clear, it usually indicates a normal gall-bladder. When it is greenish-yellow and turbid, it portends a diseased gall-bladder, which frequently contains gallstones. He states that golden-yellow bile containing mucus is observed in catarrhal jaundice, but he admits that golden-yellow clear bile may occasionally exist, notwithstanding the presence of gallstones, so his first conclusion is vitiated by the latter statement. But I would also add that sometimes greenish-yellow bile which is turbid can be drawn from the duodenum when the gall-bladder is not diseased, because the color may be due to a duodenitis, and occurs also in duodenal ulcer. The remaining conclusions of this article refer to pancreatic disease and not to cholelithiasis. In only two instances do I notice a reference to the degree of alkalinity. In Case No. 9, p. 492, the alkalinity is stated as equal to 20, and in Case 16 as equal to 25. I presume this is expressed in terms of the titration method ascertained by 1/10 normal solution of NaOH. Now, the chemical reaction of the duodenal contents, when the hydrochloric acid of the stomach can be excluded, is due more to the alkalinity of the pancreatic juice than to that of the bile. I will later point out that this alkalinity of the duodenal contents is an important factor in the diagnosis, if it can be traced as due to the bile, which, of course, is exceedingly difficult. In the article in the *Archiv. für Verdauungs-Krankheiten,* Band 17, p. 147, I described a case of varying gastric secretion to which I have given the term "heterochylia." This patient had periods during which no gastric juice was secreted, and other periods during which the gastric juice was either normal or excessively acid. When the total acidity of the gastric juice was normal

$$\frac{N}{10}$$

I found that it required 3.5 to 5 c.c. of H_2SO_4 to neutralize 10 c.c. of pancreatic juice. This patient had a small drainage tube inserted in a dilatation of the pancreatic duct after an operation for pancreatic cyst, performed by Dr. L. McLane Tiffany. The case is described fully by Dr. Harry Adler and myself in the *Medical Record* for August 6, 1898. The case is cited here as a rare instance where the human pancreatic juice was studied during life and its alkalinity ascertained; but it was found that the alkalinity varied with the character of the diet. For complete data reference must be had to the original article, and also the articles on duodenal intubation published in the *Archiv. für Verdauungs-Kr.,* 1911.

So much must be evident: The alkalinity of the duodenal contents does not inform us concerning the alkalinity of the bile. If Tinhorn finds an alkalinity of 25 this may be entirely due to the pancreatic juice. The bile itself, it is true, is alkaline, but only feebly so. Expressed by the above method, the bile that flows from the common bile duct during health has been found by me to be equal to 5; that is, 100 c.c. bile were neutralized completely by 5 c.c. $\frac{N}{10}$ NaOH. This is an average of 12 titrations. Nevertheless, a marked diminution in the alkalinity of the duodenal contents is a significant sign of the presence of disease of the gall-bladder. Should the alkalinity fall below 5 we can assume that both the pancreatic juice and the bile are prevented from entering the duodenum. I have had two cases in which a persistent low alkalinity of this type was followed in from three to six weeks by jaundice.

In estimating the alkalinity of the bile the hydrochloric acid of the gastric juice must as far as possible be excluded and the duodenal juice drawn at a time when the stomach is empty.

The most complete chemical study of the bile—from which most of my figures are obtained, is found in Bottazzi's "Chimica Fisiologica," Vol. II, p. 401, "In fegato e la bile." The tables Nos. 79 and 80 give the complete results of eight brilliant chemists on their analyses of the mineral contents and the organic contents of the bile.

Liver bile is much less concentrated than gall-bladder bile. Determinations made on gall-bladder fistulae in man give a total solid residue of about 0.11, but this bile is not normal. The findings are due to the great loss of bile from the body, for normally bile makes an intermediary circulation, being reabsorbed from the intestine and excreted again from the liver. If it is lost through a gall-bladder fistula this must lead to an impoverishment in solid substances. The liver bile contains 3.21 to 4.66 per cent. of solid residue, according to Hammarsten ("Ergebnisse der Physiologie," 4 Jahrg., "Chemie der Galle," p. 4).

The gall-bladder bile contains 15 to 17.03 per cent. of solid substances. There is a reabsorption of salts of the bile which takes place in the gall-bladder and bile duct, and simultaneously with this reabsorption of salts, organic bile constituents are secreted into the gall-bladder. The bile, if drawn at all from the duodenum, must be gall-bladder bile, and, even normally, greatly different in its solid constituents and salts from the liver bile.

The gall-bladder also secretes mucus, which can be precipitated from human bile by alcohol. It seems to be a mixture of nucleo-albumin and mucin. The genuine mucin in human bile is derived from the bile passages, and if there is a marked presence of mucus in the duodenal con-

tents it either speaks for duodenitis or for inflammation of the gall-bladder and bile ducts. A marked diminution in the total solids of the bile, apart from the organic constituents, means that the calcium or the cholesterin or the bilirubin and pigments are being retained for the formation of gallstones. There is a stage of the cholelithogenic process where the stones, after being completely formed, may undergo partial solution, provided the human subject still retains a fairly normal bile secretion. It is known that gallstones formed in man undergo complete dissolution when sewed into the gall bladder of a dog. In this stage the total solids of the duodenal contents may exceed that of normal bile from 3 to 15 per cent. This is the cholelitholytic stage or phase of gallstone disintegration.

There are, therefore, four diagnostic factors to be obtained from the chemical composition of the duodenal contents. (1) Diminution of the alkalinity. (2) Increase of the mucin. (3) Diminution of the total solid residue below the normal. (4) There may be a stage in the litholytic process where the bile as it issues from the common gall duct (*i. e.* in cases where the pericholangitis has not progressed far enough to prevent the issuance of the bile, partly or completely) contains more total solids than normal bile, the excess of solids being then mainly made up of Ca, Cholestrin, Bilirubin, or a mixture of these according to the composition of the calculi. It is conceivable that there are *cholelitholytic* bacteria, *i. e.* microorganisms that disintegrate already existing gallstones.

It has been observed by Naunyn that gallstones which were already partially disintegrated and dissolved when not expelled were reconstructed into new stones by the secretion of the inflamed gall-bladder mucosa, which is rich in calcium and bilirubin.

As regards the color, I should say that normal bile is always yellow, due to urobilin. A green bile is pathological.

If we have in view the factor of infection in a diagnostic study of cholelithiasis, the bacteriology of the contents of the duodenum can afford us very little aid, for even if the bile is excreted into the duodenum the bacterial flora which we succeed in obtaining (if we obtain any) will be that of the contents of the gall-bladder and not of the gall-bladder tissues. E. C. Rosenow has perfected newer methods for the study of the bacteriology of various infections (*Jour. A. M. A.*, Sept. 12, 1914, p. 903), and in the article, which I shall quote more fully, he pointed out that streptococci of a certain grade of virulence and from different sources are capable of producing cholecystitis and gallstones after intravenous injection, and that large numbers of the cholecystitis-producing organisms constitute the nuclei of the stones.

Rosenow describes an interesting case in which cholecystitis developed in the sequence of an acute tonsilitis. The symptoms began ten

days after the tonsilitis, and continued three weeks without jaundice. Then the pain shifted, and jaundice began, which deepened for a week. Five weeks after the beginning of the attack Dr. A. D. Bevan performed an operation. There was found a healing area of necrosis at the fundus of the gall-bladder, which was moderately distended with bile containing mucus, and three mulberry cholesterin stones. Cultures made from the bile were sterile, but cultures made from the center of the stones developed streptococci, colon bacilli, and the gas bacillus. An emulsion of the excised piece of tissue of the gall-bladder developed only streptococci. The culture and tinctorial properties of those special streptococci are described by Rosenow.

A dog was injected on January 22, 1914, with the growth of streptococcus from the wall of the gall-bladder, in 90 c.c. of ascites-dextrose broth, suspended in 7 c.c. of sodium chloride solution. On January 24 the dog was lame in the left hind leg, fluid from knee joint was turbid. Cultures were made. January 26, cultures from knee joints showed four green-producing but no hemolyzing streptococci. January 30 the animal was found dead. Examination showed acute cholecystitis, enteritis, pancreatis, nephritis. The wall of the gall-bladder was edematous 3 to 6 mm. thick, the cavity distended with brownish fluid. A plug of muco-pus closed the diverticulum of Vater. Pressure on the gall-bladder failed to discharge bile until this plug was removed by passing a probe and making firm pressure. A number of dark concretions of the consistency of putty were found in the muco-pus of the gall-bladder and in the plug. The liver was normal. The kidney showed nephritis. The lower end of the small intestine was hyperemic and covered with an exudate containing many streptococci. The stomach, large intestine, adrenals, heart, and thyroid were normal. The bile, the plug of mucus, and the walls of the gall-bladder yielded large numbers of streptococci. The blood remained sterile. Sections of the wall of the gall-bladder showed marked thickening and degeneration.

This extremely thoroughly worked out case demonstrates, first, that a streptococcus tonsilitis may induce a cholecystitis and gallstones in the same patient within three weeks; second, that a culture of streptococci gained from this patient and injected into a dog may produce acute cholecystitis, puttylike masses in the gall-bladder, a plug in the diverticulum of Vater causing complete obstruction, and the death of the animal after eight days.

This contribution of Rosenow's is of such importance that I venture to abstract it in the following:

In five cases, the cultures from the wall were negative and in these the microscopic evidence of any changes were slight. In the remaining twenty-four cases, in all of which increase of thickness and other changes were more marked, streptococci

were isolated in all but three and in pure culture in ten. In sixteen cases streptococci were found in the wall when the contents were sterile or contained only colon bacilli. The colon bacillus was found with the streptococcus in only ten cases, once in pure form, once in association with the *Bacillus welchii,* and once with staphylococcus. *Bacillus mucosus* was found in two cases of very acute cholecystitis. In two, diphtheroid bacilli were found and in one the fusiform bacillus was found. The fluid contents, usually bile, were examined in twenty-six cases: In twelve it was sterile; streptococci were found six times, colon bacilli nine times; staphylococcus three times; the *B. Mucosus* twice, and the fusiform bacillus once. The center of gallstones were examined in thirty cases. Only two proved sterile; from the rest streptococci were isolated in all but three, fourteen times in pure form and five times in association with the colon bacillus; the center of the stone, in one case, showed the typhoid bacillus in pure form while the center of two stones and the wall of the gall-bladder in a case with a clinical diagnosis of typhoid cholecystitis showed streptococcus in pure culture; in two cases the center of stones contained colon bacillus and the *B. welchii,* and one of the latter organism only; in some instances, streptococci were demonstrable in smear preparations from the center. Cultures from other portions of stones were usually sterile. The adjacent lymph-glands were examined in five cases. Streptococci were found in four, pure in three cases and in association with *B. welchii* in one case. In the cases in which a pure culture of the streptococcus was obtained from the tissue of the gall-bladder there seemed to be a definite relation between the number of colonies which developed and the degree of change, especially if relatively recent inflammation was present.

A comparison of the results obtained from the bile, the stones, and the wall of the bladder, in the individual cases, shows that a bacteriological examination of the fluid contents gives trustworthy results only in the acute stage of the disease; during convalescence and in chronic cholecystitis the results are of little value and may be misleading. In chronic cholecystitis the bacteriology of the center of the stones is similar to that of the wall of the bladder.

The effect of the various organisms on intravenous injection has been tested in dogs and rabbits. All of the five strains of streptococci isolated from the wall of the bladder, one strain from an adjacent lymph-gland, and two out of five strains from the center of stones exhibited marked affinity for the gall-bladder soon after isolation, and frequently produced no lesion elsewhere. Varying doses produced cholecystitis in nearly every animal injected. The severity of the lesions in the animals often corresponds to that found in the cases from which the strains are isolated. This affinity is soon lost, however, on cultivation as well as on animal passage. Five strains of colon bacilli, the one strain of typhoid bacillus, and one strain of the bacillus mucosus in no instance showed any tendency to localize in the gall-bladder. It was not possible to produce cholecystitis with the streptococci by injecting them into the portal system, even with strains which produced cholecystitis practically every time when injected into the vein of the leg, and only localized cholecystitis developed at the point of puncture when the injection was made directly into the gall-bladder. In the animals which lived for a time, there was not infrequently observed the beginning formation of gallstones containing numerous streptococci similar to the conditions found in several of the patients.

The strains of streptococci from the different cases show a striking similarity and resemble closely those from ulcers of the stomach. They produce either small, moist, grayish-brown or grayish-green, non-adherent, non-hemolyzing colonies on blood agar; they ferment mannite, lactose and salicin; they produce short chains in liquid mediums with clumps of cocci somewhat resembling staphylococci; they are of a

rather low virulence, yet somewhat more virulent than strains from gastric ulcers, as manifested by their resistance to phagocytosis, by the smaller dose necessary to kill, and by the fact that, when cultivated for a time, they acquire affinity for the stomach and duodenum while the strains from ulcers, when passed through one or two animals, acquire affinity for the gall-bladder at the same time they lose affinity for the stomach.

On animal passage, two of the strains produced both cholecystitis and pancreatitis, the lesions in the latter being most marked in the head of the pancreas.

The lesions most commonly observed other than cholecystitis, when these strains are injected especially in rabbits, are: ulcer of the stomach, hepatitis about the gall-bladder, myositis and myocarditis, arthritis, appendicitis and colitis. The common presence of streptococci in the wall of the infected gall-bladder and in the center of gall-stones, often in pure culture, while absent from the bile and their affinity for the gall-bladder in animals are strong evidence that streptococci are the cause of cholecystitis in man far more frequently than believed and serves to explain the good results reported by some as following cholecystectomy in cases of myocarditis, arthritis and other conditions.

So far as the diagnosis of the bacterial cause of cholecystitis from the contents of the duodenum is concerned, these studies of Rosenow are discouraging for the efficacy of duodenal intubation in this direction, inasmuch as the bacteria which have caused the cholecystitis are not present in the bile as issuing from the common gall duct. They cannot even be detected in the blood, but were found only in the wall of the gall-bladder itself. The problem is more promising of solution when we are dealing with the Eberth bacillus of enteric fever. If this is the cause of the cholecystitis, it is as a rule present in the bile coming from the common gall duct, and it is this class of patient that constitute the so-called typhoid fever carriers.

The bacterium which is the cause of the gall-bladder infection cannot always be isolated from the liquid contents (the bile), although it may be from the wall of the bladder and the center of the stone.

It is not necessary to undertake puncture of the gall-bladder through the intact abdominal wall, as Levy and Naunyn have done, in order to endeavor to ascertain the specific microorganism. This can be obtained by duodenal intubation, often gentle massage of the gall-bladder through the abdominal walls, by setting up of the bile evacuating mechanism by injecting HCl and albumoses into the duodenum.

In case there is an obstruction of the cystic or of the common gall duct, this procedure cannot prove successful. It is therefore necessary first to find out whether these ducts are permeable. The most practical method to ascertain this is the examination of the stools. If there is fecal acholia, then duodenal intubation can bring no bile. I must add, however, that there have been two cases in my experience where I obtained bile in quantities of one-half to one and one-half c.c. even when the chemic test and appearance of the stool gave no evidence of it. It

is possible that the small amount of bile that reached the duodenum was reabsorbed before it reached the colon.

But if any bile reaches the duodenum at all it can be aspirated by the method of duodenal intubation which was first practised by me in 1897, in the University of Maryland Hospital. Physiologically, the sphincter at the papilla of Vater opens only when the gastric chyme spurts into the duodenum; when the stomach is empty there is no evacuation of bile, but I will show later that this sphincter can be made to open by injecting a solution of hydrochloric acid and pepsin into the duodenum. It has been said that hydrochloric acid by itself will effect this, but it is more efficient if pepsin is added. The most efficient substance to effect the relaxation of the sphincter at the common bile duct is a filtrate of human gastric contents obtained from a normal individual.

All of these substances have a certain degree of acidity which has to be ascertained beforehand, to deduct the amount of 1/10 norm. KOH necessary to neutralize their acidity in calculating the alkalinity of the duodenal contents after they are drawn. 1 c.c. of normal gastric filtrate from a human individual may cause the evacuation of between 10 and 12 c.c. of bile. A few drops of the HCl pepsin solution suffice; these can be aspirated and the subsequent bile expulsion used, which is, as a rule, free from the injected HCl.

The hydrochloric acid or the filtrate of human gastric contents thus injected causes the formation of secretin from prosecretin, which in turn evokes the secretion of pancreatic juice, and is supposed also to cause a secretion of bile, though not all investigators are agreed on this latter point. (See Falloise, quoted in Maly's "Jahresberichte der Thier-Chemie," 33, 611, 1904.)

Treatment.—The course to pursue in aiming at a treatment of cholelithiasis that is based upon the cause would be to first ascertain the specific bacterium which is causing the infection, and thereafter to obtain a serum by inoculating animals with this special strain of organisms. In one of my cases of chronic cholecystitis with occasional attacks of high fever that followed three months after a severe streptococcic tonsillitis, anti-streptococcus serum apparently cured the patient, for she has remained without symptoms for two years and two months.

There is a justified doubt in this case, for there are periods of two years' quiescence in many gallstone cases, after which the cholelithiasis may again give rise to symptoms. Moreover, according to Rosenow, only the particular strain of streptococci that had been derived from a case of gallstone disease should be used to produce the serum. It is conceivable that the specific strain of streptococci might be cultivated in these cases from the tonsil.

The difficulty will be to secure the proper strain of bacterium which is doing the mischief, but I believe that with patient research by the method of duodenal intubation, and making use of the neuro-chemical mechanism which controls the sphincter of the common gall duct, marked advances in the diagnosis and therapy of this condition will be made.

The treatment of cholelithiasis has different aspects in view, and varies according to the diagnosis of the conditions present. It will also vary according to the causes of the conditions.

It is necessary to plan a special treatment for the following four conditions: (1) The gallstone colic with the acute occlusion of the common gall duct and the recurrent cholelithiasis. (2) Inflammation of the biliary vessel and reservoir system (gall-bladder, cystic duct), the acute cholelithic cholecystitis, with its consequences: (*a*) perforation peritonitis, (*b*) diffuse cholangitis, (*c*) chronic cholecystitis, with empyema and dilatation of the gall-bladder. (3) The invasion of the deeper bile passages by the stones, chronic occlusion of the gall duct. The differential diagnosis and management of the various types of icterus. (4) The consequences and complications of cholelithiasis and malignant neoplasm of the gall-bladder.

The principle of non-surgical treatment of cholelithiasis is to bring about a period of quiescent latency in the disease. Complicated infections, and all factors that tend to stagnation of the bile, may have stirred up a dormant disease. Of course, this can be treated by operative removal of the gallstones and draining the gall-bladder. From what we have seen in the preceding, however, only 5 per cent. of all gallstone carriers ever have symptoms. This makes it clear that there must be a great majority of the subjects of cholelithiasis who harbor their stones throughout life with a comparative degree of comfort, or are not aware that they have gallstones.

I am not at all opposed to the operative treatment of gallstones. On the contrary, I favor it. (See article on "Cholelithiasis" in the Analytical Cyclopedia of Practical Medicine, Volume 3, page 295.) I also there call attention to the technique and value of duodenal lavage in the treatment of cholelithiasis. But there are plenty of patients who refuse to be operated upon, or who never have a second attack, or who have been operated upon already and in whom the cholelithiasis returned; such cases, in short, that demand nonoperative treatment.

For the present I shall pass over one of the most effective therapeutic methods of the internists, namely, the treatment by hot mineral waters and diet.

I wish to emphasize what I have repeatedly condemned, namely, the employment of so-called cholagogues, especially a number that appear

to be proprietary articles. Any agent that causes a hemolysis of red blood cells will increase the flow of bile, and the same effect is produced if a solution of hemoglobin is injected directly into the blood. The bile pigments are excretory products of hemoglobin. Most all so-called cholagogues are hemolytic and also protoplasmic poisons to the hepatic cells.

The use of olive oil, either by mouth or rectum, in large doses, has in my experience not been followed by gratifying results. It has been claimed that concretions can be found in the stools after the oil treatment, and that they are the result of broken down gallstones. I have convinced myself that these concretions are nothing but fat conglomerations, and that the large doses of olive oil, as given by Stewart and Mays, derange the digestion. It would be pardonable if a slight improvement followed the treatment with the substances which I have just mentioned, if we were sure that they did not do harm. Cholelithiasis is such a complicated and variable disease that improvement frequently follows rest in bed, hot Carlsbad or Bedford magnesia water, and hot applications over the liver.

It is entirely irrational to speak of a solution of gallstones by medical means. What the cholagogues are supposed to do is to increase the flow of bile, in order to wash out the biliary passages. If it were really possible to increase the *secretion* of bile it is not at all proved that an *increased* flow of bile through the gall-bladder, common gall duct, and into the duodenum would follow. It is not sufficient to increase the amount of bile secreted. What is needed is an increased flow of bile through the biliary vessels. This is, in the normal individual, prevented by the sphincter of the common gall duct. In 1887 Oddi showed this sphincter anatomically, and he also demonstrated that it is controlled by a group of ganglion cells which regulate the constriction and relaxation of the sphincter. (See illustration in Luciani's Physiologia del Uomo, Vol. 2, pages 187 and 188.) The same sphincter was studied by Hendrickson (*Johns Hopkins Hospital Bulletin*, September, 1898.) Oddi found that the force with which the sphincter closes can only be overcome with a column of water of 700 mm.

Freese (*Johns Hopkins Hospital Bulletin*, June, 1905) found the force of the maximal contraction of the muscle of the gall-bladder to be 220 mm. of water; also the same pressure was found by Haidenhain. This pressure varies according to the animal experimented upon, and Naunyn assumes that the force with which the sphincter of the common gall duct is kept closed is equal to a pressure of 700 mm. of water. This is Oddi's estimation. Such a pressure is far greater than could be overcome by an augmentation of bile secretion, for the secretory pressure of the human bile apparatus doesn't go beyond 250 to 300 mm. of water. Whenever the pressure in the bile ducts exceeds this the

hepatic cells no longer secrete into the gall ducts, but any bile that is formed is received into the lymph vessels which surround the hepatic cells, and eventually reaches the thoracic duct.

The reciprocal neuromuscular control between the sphincter of the papilla of Vater and the muscle of the gall-bladder can only be set up normally by the products of gastric digestion, and in such a manner that the sphincter at the orifice of the common gall duct is inhibited when the gall-bladder contracts, and *vice versa*.* To produce an increased flushing of the gall ducts and gall-bladder with bile, the sphincter of the common gall duct must be opened. Physiologically this occurs during gastric digestion and evacuation through the pylorus. Assuming that cholagogues could augment the formation of bile, as yet there is no evidence that they can open the sphincter of the common gall duct, the tonus of which will remain 400 mm. of water pressure higher than the pressure of bile secretion.

*The reciprocal innervation of the gall-bladder and biliary ducts has been studied by Doyon (Archives de Physiol., 1894, p. 19).

DISCUSSION ON PAPERS

By DRS. SATTERLEE, AARON and HEMMETER

Dr. Ernest Zueblin of Cincinnati, O., said these papers covered the subject from the diagnostic and therapeutic standpoints. It was necessary to be more than careful in diagnosis. Duodenal ulcer meant a series of examinations which were usually most disagreeable to the patient. In regard to the duodenal contents examination by the Einhorn tube and the string test might be valuable. Objection was frequently made to the string test, but this might not be so much the fault of the method used as of the interpretation of the result. The string and bucket should be swallowed in the evening and withdrawn the following morning. If the blood stain was in the yellow bile-stained portion close to the attachment of the duodenal bucket, there was strong probability of a duodenal ulcer. As to the toxemia, the catabolism of the proteins might be interfered with by faulty digestion and the general organism might suffer by faulty absorption, or there might be a kind of anaphylaxis with symptoms reflecting on the other organisms which were falsely interpreted. In regard to lavage, Dr. Aaron last year had made observations on the effect of duodenal lavage in lowering high blood pressure. He would like to know more about the histories of these cases. The statistics of Dr. Freeman were very valuable as showing what could be done in the treatment of ambulatory cases. The medical treatment of this condition could not be exclusively medical, one had to defer to the surgeon in many instances; at the same time, operations were often needlessly performed. Physiological tests were necessary to complete the diagnosis. As regarded belladonna, it was probably necessary to employ heroic doses, but did the patients not complain of eye symptoms or other toxic symptons? It was no doubt necessary to choose the lesser evil, but it would be surprising if there was no intolerance.

Dr. Douglas Vander Hoof of Richmond, Va., said that good team work was necessary between the internist and the surgeon. It had been his practice for 12 years to have a consultation with a surgeon about these patients with duodenal ulcer. He did not do this so frequently as formerly. The doctor was apt to formulate in his own mind the procedure of choice. The question of age entered into this matter. After 40 years of age medical treatment was advocated rather than surgical. The situation of the ulcer was likewise considered. One felt particularly unhappy about ulcers situated near the pylorus because of the possibility of malignant disease. Ulcers in the duodenum were the easiest thing to diagnose clinically. Competent x-ray diagnosis should be sought. In regard to treatment a plan of simple routine was of most use. Many features had been discussed that morning, but a few should be emphasized. One thing was frequent feeding. These patients must be fed 6 times a day. They should never go without feeding every three hours, even if the church or the house was burning down. This was not for a month or two, but for 18 months, and not omitted a single day. It was possible to undo in 2 days all the good of two months. Cooperation of the patient was essential. If pain occurred a glass of milk should be taken. This could be done 5 times a day. One intelligent patient, a man of 70, had had occasion to take milk 5 times during the night. He had continued to follow this treatment of frequent feeding and taking milk and had had no return of symptoms for 5 years. Olive oil taken alone as the first course of a meal, or a cup of cream 3 times a day before meals, was a useful measure. After meals bismuth nitrate, 3 parts, and calcined magnesia, 1 part, were used. In regard to diet, these patients should not be restricted as in general they had too much digestion. Acids and acid fruits were forbidden, as were soups, meat extractives, and alcohol, and tobacco. Seasonings, such as salt, Worcestershire sauce, etc., were to be avoided; intense sweets like honey and molasses were harmful. There was no restriction of meat or of starches. These means would afford great relief and a clinical cure. The only objection to medical treatment was that one was apt to overlook associated lesions in the abdomen. The great advantage of surgery was the opportunity for complete exploration. Cases that failed to yield to medical treatment were no doubt associated with appendix or gall bladder conditions. It was interesting to hear about the doses of belladonna which the patients had tolerated. He had tried to run belladonna up, but the patients complained bitterly of disturbance of vision. It was possible that the dispensary patient did not use the eyes so much. In complicated duodenal ulcer cases the patient should be carefully watched and if he did not do well, a surgical consultation should be asked for. Medical treatment should not be persisted in unless the patient got well.

Dr. Jacob Diner of New York said that he was interested in what Dr. Aaron had said about magnesium sulphate. This drug is very interesting. It was supposed to be passed out through the gastrointestinal tract and from the bowel. As a matter of fact it was found to be reabsorbed by the colon and excreted by way of the kidneys and had a stimulating effect on the renal epithelium. Its disagreeable taste was one objection to its use. It could, however, be made very palatable by the addition of aromatic sulphuric acid (two per cent), and sweetened with glycerin. With reference to bismuth, he believed that in peptic ulcer it was indicated because it acted as a demulcent just as milk did, upon the mucous membrane. Olive oil had the same effect. Bismuth subnitrate, used internally, was readily broken up and liberated nitrous acid. This was irritating. Bismuth oxide could be used instead, or milk of magnesia. He expected to hear Dr. Aaron speak of the effect of exercise on stasis. Most of the people followed a sedentary occupation and the stasis was

more or less due to that. Gradually increasing exercises, combined with doses of magnesium sulphate which cleared out the intestinal tract, would overcome the condition.

Dr. Thomas F. Reilly of New York said that Dr. Freeman said he could diagnose these cases by the hypermotility, but in the fluoroscopic examination it could be shown that any drag on the intestinal tract produced hypermotility. How could he rule out gall-bladder conditions, from the hypermotility due to ulcer? These patients often presented a peculiar pallor which was of some assistance in the diagnosis. A large percentage of these cases also had a positive Wassermann. A Wassermann should be done in all cases. In regard to the occurrence of pain, often it was found that before an attack of pain the patient had had a severe nose cold, or some other infection, which had started up the attack. Most of these cases got well after 3 weeks or more of treatment, but the return of symptoms was one of the diagnostic points of the condition. The pain in the upper right quadrant made it difficult to differentiate from gall-bladder trouble. In regard to treatment, every practitioner had his own fads. Personally, he was fond of the bismuth subnitrate. He thought there were better results than with other bismuth preparations. The bismuth should be given before meals as it protected the ulcer during the passage of food. Patients often said that they did better when taking "the white medicine before meals." One hour after meals the patients were given bicarbonate and magnesia. Occasionally calcium was indicated because of diarrhea. Ten grains of oleosaccharate of cloves was used as a carminative to disguise the taste, and to relieve pain. Milk was given 3 hours after a meal and the powder one hour after meals. In regard to the bismuth, it may be mentioned that patients who had had large doses for diagnostic purposes were suddenly relieved of symptoms and felt well for two or three weeks. Roentgenologists have frequently noticed this phenomenon. The salts used were usually the sub-carbonate or barium salts. It was usually better to give the patient a diet list to go by; they were apt to forget verbal instructions as soon as they got out of the office. A dry diet at meal times was better, with glasses of milk between meals. Tea and coffee were almost always badly borne. These patients usually felt better lying down. One could give these patients more rest by means of abdominal supporters of stockinet. Provided no pressure was exerted this appliance afforded comfort and made for recovery.

Dr. Francis E. Stewart of Philadelphia said that in regard to the use of belladonna, hyoscyamus was more apt to disorder vision than any of the atropine group. In regard to bismuth preparations, the finely divided type of powder penetrated better into the villi of the intestines. Microscopically there was a great difference in the action of the large crystals and of the minute kind. The flavoring of the magnesia salts with aromatics had been patented, so that one might be infringing trade rights in this particular.

Dr. E. McGuire of Richmond, Va., said that he had been very much interested in these papers. He did not hesitate to say that formerly he referred many more cases to the surgeon than he did now. He believed that gastric ulcer should be treated properly to get good results. Absolute rest in bed arrived at this end. He never gave the patient ambulatory treatment if it was by any means possible to put him to bed for two or three weeks. He had made use of the various methods described. He preferred the subnitrate salt of bismuth to the subcarbonate. It was necessary to neutralize the gastric juice. One important thing in cases with retention was that these people should have their stomachs emptied at night. This should be done at 10 P.M. with the stomach tube. At 8 A.M. the patient was fed.

The stomach was thus put at rest for the night. Four or five years ago he had a case with retention of 400 c.c. The case was *x*-rayed. The man had lost 35 pounds and begged to have something done for him. The stomach of this patient was emptied every night. He was put on a diet and had alkalies. In five or six weeks he improved very greatly. The treatment was continued and after 5 months the man was perfectly well, had regained his weight, and there was no sign of retention. That case was due to inflammation of the submucosa and when the ulcer was relieved the opening became larger. Therefore these cases were not now referred to the surgeon until efforts had been made toward relieving the obstruction by medical treatment. Dr. Morris had spoken of gastroenterostomy, but three-fourths of these cases had the ulcer situated on the lesser curvature, where no surgeon could possibly reach it. Many of these cases, *x*-rayed after gastroenterostomy, showed that four-fifths of the barium passed out through the contracted opening in the pylorus and not through the gastroenterostomy. He felt that gastroenterostomy was done entirely too often. If surgery was done, it should be excision of the ulcer. A pyloric ulcer could be excised. Their friends, the surgeons, could get much better results if they treated their cases medically for a time. Many cases of ulcer that submitted to operation should never have been touched.

Dr. R. T. Morris of New York said that the discussion had been carried on by experienced men, but what the surgeon would like to ask was what was the easiest way for the patient? If one went to Canada should one go over the falls or across the suspension bridge? There was about that much difference in the treatment. He had had patients come into his office apparently starved. They had traveled to the different resorts, and would have had a good time, only they were starved. He told them to go out and get a good dinner of corned beef and cabbage, with a glass of ale, then, later, they could talk about surgery. Sometimes they did not need much further treatment. In regard to peripheral irritation, some patients had eyestrain, loose kidney, hemorrhoids, or other disturbances. Sympathetic disturbances might give rise to symptoms related to the duodenum. No matter whether the ulcer was cephalad to the duodenum or caudad to the pylorus, one knew, as Rosenow had shown, that the tissues had a selective affinity for toxins. These toxins caused injury to the terminal arterial system, sometimes accompanied by plastic exudate producing endarteritis and increasing susceptibility to bacterial attack upon anemic areas of tissue. They were dealing with a particularly susceptible group of patients who easily succumbed to toxic influences. What happened if one relieved peripheral irritation such as nasal hypertrophy, unerupted molars, etc.? His idea (which might be wrong) was that when the peripheral irritation was removed, the ulcer disappeared, not because it was reflex in origin, but because peripheral irritation had been exciting serious disturbance which resulted in toxic formation in the bowel, causing improper metabolism and tissue changes in the body, and faulty excretion of toxins. Removal of the cause would thus affect the ulcer. That brought in another question, that of more elaborate diagnosis. He had been actively engaged in surgery for 35 years; he did not need to operate on any more ulcer cases. He would rather go fishing, but when the patient came he wished to give that person the best advice he could. Surgery might be suggested for some; for others medical means would suffice. He much preferred to have a laboratory diagnosis made and laboratory facilities applied; by that time the patient had so little money left that the surgeon could not be accused of wanting to charge him a fee. It was very necessary that all of the factors should be worked out in regard to peripheral irritation and focal infection. He had seen many patients recover from ulcer after removal of badly infected tooth roots, with

Streptococcus viridans infection. In ten patients with this infection there might be no ulcer, but in the eleventh case the patient had become sensitized to the organism. Patients had been known to recover from gastric ulcer after removal of an infected tonsil. It required much more judgment to know just what kind of tonsil should come out, than it required skill to remove it. The psychic factor was a strong one and one that could not be overlooked. Some patients would gain in weight and spirits under any form of treatment for a while. Later they turned up in the hands of some other practitioner. At present the speaker said that he operated only where the radiograph showed distinct obstruction as the result of those "cobwebs in the attic," adhesions. Dr. Aaron had told them that the patients would get well with duodenal lavage even if the kinks were left. Good results had been gained by the Jutte tube. If operation could be avoided, he was glad to avoid it. On the other hand, patients spent years of invalidism because of neglected operation. One patient of his in New York had made his stomach his occupation for 20 years, and after the removal of four little gallstones, he became a well man. A point to be decided in an association of this sort was to know in just which cases surgery was required. Dr. Satterlee's own case showed that there was a toxic order of events and involvement of the appendix and duodenum simultaneously, as Rosenow had shown to occur. One doctor in New York had recovered from appendicitis without operation, and from that he argued, by his own personal experience that it could be done. He was asked if the personal experience of those who died ought to be considered.

Dr. L. H. Taylor of Washington, D. C., asked Dr. Morris if he had followed up the allergic origin of gastric ulcer.

Dr. Morris said that he had not worked up any further points in the matter. He was still more convinced that allergy was a word one needed to use a great deal in regard to patients who developed ulcer from toxic effects. The patient had become sensitized.

Dr. N. P. Barnes of Washington, D. C., said that in regard to etiological factors, the focal lesion might be very far from the resulting ulcer. No matter whether ulcer occurred or not, any focus of infection, whether in tonsils or teeth, should be removed; one could, however, as Dr. Morris said, make cures by removing the focus of irritation. In regard to diet, one was apt to lose sight of the gastric physiology. Some foods would produce hyperacidity and some would not, but what should one do with the acids of the stomach? Corned beef and cabbage would burn up the acid, but they would train the glands to produce more acid; the carbon-dioxide, sodium chloride and water would produce more HCl again. Fats and oils lessened the hyperacidity, that was why Dr. Vander Hoof had success with the olive oil before meals. It acted as a shock absorber. Hyperacidity was a common trouble with pregnant women and very small causes acted to produce it. One saw something bad; one smelt something bad; one got a blow on the knee with acute pain, and the effect was produced. A drug was presented before this society 2 years ago by Dr. Friedenwald, who reported the success he had had with the use of scarlet red. Good results had been obtained with this agent. Magnesium oxide had been used with good result also instead of carbonate of soda.

Dr. W. Wayne Babcock of Philadelphia said that 7 per cent. of men of the first draft were rejected on account of hernia. There were 200,000 cases of hernia sent up for repair. A very large number of men must have been rejected for duodenal ulcer and it became important to know what should be done with these men. A few weeks ago a conference was held of the chiefs of the surgical service in camps and it was stated that in none of the camps had any operation been done

for gastric or duodenal ulcer. The consensus of opinion was that operation for ulcer was not to be recommended, because after the operation it would not be possible in the service to arrange the proper diet for a long enough time to make a satisfactory cure. It would not be possible to send the men back with the assurance that they were cured, yet it was possible for many patients to go back to full duty and no severe symptoms, without an operation. This was an important question for the government and for the soldier. The government spent about $200 to fit a man out, and this money was lost if he had to be sent back again. The soldier also had a right to be made as fit as possible. If ulcers could be recognized at the time the man came in, and if he could then be given specialized treatment, he could probably give certain useful service. The former ruling in the army was that if a man needed operation, and the surgeon certified that operation could be done without appreciable risk to the man, and the man refused operation, he could be brought before a court martial. One man was brought before the board for having refused herniorrhaphy and he got off. The new ruling said that if a soldier had any condition which could be relieved by operation, and he refused treatment, he could be tried and punished. Many of these men were afterwards fitted for non. com. service. In regard to ulcers, many no doubt perforated without previous symptoms. Many cases went on to cure without operation. The question of syphilis and ulcer should be considered. The dean of Atlanta medical college said that 60 per cent. of the white patients reporting at their clinics had syphilis, and 85 per cent. of the colored patients, showing that the incidence in all cases was exceedingly large as regarded syphilis. In regard to Dr. Satterlee's experience of ulcer following typhoid immunization, he would like to ask if Dr. Satterlee had had hyphoid before. He had seen a case of acute cholecystitis apparently precipitated by typhoid prophylaxis. The man had had old gall bladder trouble. The technique of the treatment of gastric or duodenal ulcer was important. Often surgeons in operating made a slight longitudinal twist by suture. This would produce blocking of the peristaltic impulse with regurgitation and vomiting. If the area of anastomosis were permitted to sink into the lesser peritoneal cavity, or if the opening into the mesocolon were brought down so that part of the jejunum were permitted to get into the lesser peritoneal cavity, the same result would obtain. If the jejunum were not freed the contents would pass back into the stomach so that a large number of secondary symptoms and even deaths that followed these operations were often due to technical errors committed by the surgeon.

Dr. Aaron said that it was the old question as regarded a carbohydrate or a protein diet. He was inclined to think that every man should follow out his own best method of dieting in gastric ulcer. The cause of pain in gastric ulcer had recently been brought out by Carlson, who pointed out that the pains of gastric and duodenal ulcer were contraction pains arising in the stomach or in the pylorus. The contractions were usually not stronger than those of normal digestion peristalsis of the filled or the hunger tonus rhythm of the empty stomach. This pointed clearly to a condition of hyperexcitability of the gastric pain nerves in the ulcer patients experiencing the typical ulcer pains. Therefore ulcer pains were due to tension of excessive contractions or of normal contractions on hyperexcitable pain nerves. As regarded bismuth, the subnitrate was to be preferred to the subcarbonate. Bismuth subnitrate being insoluble in water was chemically inert under ordinary circumstances. A small part of the total quantity introduced in the stomach was decomposed in the acid gastric juice or duodenum, liberating nitric acid, and it was only after this process had taken place that the chemical action of the bismuth began. The

chemical action of bismuth within the stomach and duodenum was antisecretory, astringent, and antiseptic. The bismuth subnitrate having been decomposed in the acid gastric juice, it was the simultaneously liberated nitric acid which produced the astringent effect. This astringent process was one of the mildest, but might be made to last a long time, since only a small amount of bismuth was decomposed at a time, and the total quantity remained in the stomach for hours together; the dose, however, should be repeated often enough to supply the loss from disintegration. Thus it was possible, with the aid of bismuth, to maintain a uniform gently astringent process for weeks and months. An objectional feature of bismuth subcarbonate was that, on entering into combination with hydrochloric acid of the stomach it released a certain amount of carbon dioxide, which under certain circumstances might give rise to considerable distension of the gastric wall and the ulcer. Besides, the beneficial effect of the liberated nitric acid was lost.

Dr. Satterlee said that he had taken up the subject of duodenal lavage, in kinked intestine with toxemia, and had used the Jutte tube in a series of cases of intestinal toxemia with good temporary result. He then thought he would control these cases by *x*-ray examination as it was not certain the tube went into the duodenum. The tube was *x*-rayed *in situ*. It was found the duodenal tube was often still in the stomach. Epsom salts were used and immediate evacuation of the bowel caused relief. Filling the stomach with fluid was then tried, and at last he came to the conclusion that he was wasting his time with the duodenal tube.

Dr. Aaron asked if the patients had any discomfort from putting fluid into the stomach.

Dr. Satterlee said that he thought there was more discomfort in the stomach because the fluid was absorbed in the duodenum. He thought the subject of infection should be more fully emphasized and more attention be given to treatment of tonsils and apices of teeth. The infection must not be forgotten. If ulcers could be treated by argyrol, scarlet red, silver nitrate, etc., the logical way was by local applications. He had not got a large enough series yet. It needed unusual pains, as not one patient in fifty would help in following the case up. One good feature of duodenal lavage was that it caused diuresis, the patients had to pass water at once and sometimes the bowels moved as quickly. Duodenal lavage with saline or salts cleared the bowel of toxic material in a very short time, but in his experience did not cure, any more than epsom salt by mouth cured. The reason was that the wall of the colon and especially the cecum was diseased, infected. He believed these people should be immunized against the autogenous colon bacillus. Many people had been relieved and cured after five years, by immunization by the autogenous organism. All sides of the question had been considered and it was found that the patients came back for the autogenous vaccine. They felt better for it. There was no psychological effect in that. As to operative procedure for the relief of duodenal ulcer, he thought Von Mickulicz's plastic operation was to be preferred, but many ulcers were impossible to remove; they were situated on the posterior wall. In his own case this was so and it was an inoperable ulcer. By making a short no-loop posterior gastroenterostomy with a hole across the pyloric antrum immediate relief was obtained. There was no room for bad results. The toxemia was cleared up and this would no doubt be the operation of the future. Relief of pain helped, but it did not cure. He had tried all preparations of bismuth and he believed that bismuth subnitrate was to be preferred. Magnesium oxide was also given in large doses. The minute a scab was formed there was chance for pus to collect underneath. Alkalies and bismuth should be given simultaneously. Rest would cure any ulcer,

but one had to consider the economic status of the patient. If he had to be on the job he must be got into good shape as soon as possible. The question of gastric residue was no argument for or against gastroenterostomy. Many of these cases had been operated on because the surgeon did not know what else to do. The trouble was not there, but lower down. If there was stasis in the appendix or the cecum, there was good ground to work on. The incidence of typhoid in Dr. Freeman's cases was interesting. In his own case, Dr. Satterlee said he had never had typhoid. He had 3 prophylactic injections without reaction, except intestinal symptoms. It was possible that the toxin was irritating to the duodenal mucosa. This was the cause of the ulcer. He had found a vegetable diet the only one suitable to his own case. Most cases could not take meat. The effect of bismuth barium salts upon patients who were *x*-rayed, was due either to sedative or stimulative effects of the *x*-ray. With the continuous *x*-ray series a large percentage of the patients got better. Improvement in medical treatment should certainly limit the number of operations. He did not see why frequent feedings should be given. It might help the pain but it did not cure the patient. He had tried gastric lavage, but got poor results because the patients were hungry and pain occurred when the stomach was emptied. Gastric ulcer had recurred after excision in a large number of cases. so that results in gastric ulcer had not been so good as in duodenal ulcer. Joseph C. Friedman of Chicago had stated that the pain in duodenal ulcer could be caused by collections of gas due to the spasm of that organ. In some cases that was true and it was in these cases that the free hydrochloric acid was often deficient. Administration of dilute hydrochloric acid helped here, and this was one argument against the theory that excessive hydrochloric acid was the cause of the pain in duodenal ulcer.

Dr. Freeman said that in regard to belladonna, he had used the hyoscyamus group. Very few of the patients had complained of eye symptoms. He had also used the drug in his private work and, as a rule, without complaint. In regard to focal infections in the mouth, dispensary cases as a rule had bad teeth. A great majority of them had some infective condition and one could not draw very definite conclusions. Symptoms sometimes failed to yield after the mouth had been attended to. As to hypermotility, any lesion in the gastrointestinal tract might be associated with hypermotility. One reason for making the 18 hour study with the fluroscope was that in cases where there was appendix or gall bladder conditions, or peritoneal adhesions, one could eliminate these conditions by fluoroscopic study. Where there were upper right quadrant adhesions, the gall bladder was drawn to the right. The duodenum was higher. The hepatic flexure with the colon were drawn towards the gall bladder. There was practically a normal position of the stomach and no increase in peristaltic waves. The stomach musculature was in good condition.

SERA AND ALLIED MATERIA MEDICA IN WAR TIME

By DR. A. PARKER HITCHENS
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(Abstract)

In war time the increased call upon physicians, nurses, and hospitals, made it necessary that the civil population be protected as much as possible by prophylaxis against typhoid fever. Prophylactic typhoid vaccine was as

certain in its value as that against smallpox; it had no serious effects and it became now, more than ever, the duty of physicians to demand vaccination of all classes against typhoid fever. While the value of prophylaxis against typhoid was assured, the profession were still in a deplorable state of ignorance in regard to the action of bacterial proteins in other diseases. The writer had been studying especially the properties of a vaccine against common "colds" and was certain of its immunizing value. It had been charged that this vaccine was a "shot-gun" prescription, but this fetish could be abandoned, because the vaccines being made in this country against gas gangrene were shot-gun prescriptions in that they were intended to immunize against the *Bacillus welchii* the tetanus bacillus and the perfringens, at one time. A composite antiserum would be produced. Though not yet sanctioned officially by the army, this was the right line upon which to work. Colds were a mixed infection caused by any organism capable of growing on the mucous membrane of the upper respiratory passages. Some of the best members of the profession at Camp Greenleaf were most enthusiastic about the use of a mixed vaccine to prevent colds, pharyngitis, and even pneumonia. Respiratory infections had been the worst troubles in the camps. Disease below the diaphragm had given no trouble at all. At Camp Greenleaf the streptococcus, the pneumococcus, and the influenza bacillus were the chief offenders. It was necessary before the approach of winter that patients be immunized against the colds that proved so troublesome. The high incidence of lobar and of lobular pneumonia at the camps rendered it imperative before the cold weather to provide a serum of therapeutic value against respiratory infections. Hemolytic streptococcus infection, the source of pneumonia and empyema, must be combated. Cerebrospinal fever was of great interest in the army camps. The value of antimeningococcus vaccine had been tried out. The 89th division at Camp Funston were vaccinated and this division followed abroad to test the immunity conferred. The diagnosis of this disease was not difficult, and if a case of headache were reported, the spinal fluid was examined at once. If the fluid was cloudy, the boy was treated as a case. Headache, vomiting, rash, stiffness of the neck, and Kernig's sign were diagnostic of the disease. Often there were no cerebrospinal symptoms, the disease taking the form of septicemia, toxemia, or joint involvement. Intravenous injection of antiserum was given early, the fluid being allowed to run out slowly, to prevent invagination of the tissues. The head of the bed was raised to get a downward flow. If the patient was extremely toxic, three such injections were given in 24 hours. Then the foot of the bed was raised to allow a flow into the ventricles. With early treatment the death rate had come down to 35 per cent. If the organism was very virulent, the death rate was, of course, higher. In civil life boards of health would deal with this matter, not only to save the patient, but to stamp out a focus of infection. Sanitary meas-

ures would do a great deal. In gathering men for the army, however, it must be remembered that the government was gathering together many carriers of common diseases. Active immunization, therefore, in both civil and military life, was indicated at the present time.

THE SERUM AND VACCINE TREATMENT OF THE PNEUMONIAS

By FRANCIS E. STEWART, M.D., Phar.D.,
Philadelphia, Pa.

The old classification of pneumonias as lobar pneumonia and bronchopneumonia is giving place to a new classification, namely: pneumococcus pneumonia, streptococcus pneumonia, and mixed pneumonias in which both the pneumococcus and streptococcus, and sometimes other microorganisms take part. Attention should be directed to the excellent work done at the Rockefeller Institute in regard to types of pneumococci and their specific etiological relations to the pneumococcus pneumonias. The serum treatment of the pneumonias and the possibility of immunizing troops and civilians against the pneumonias should be considered.

The work of medical scientists and the results of their findings in this connection will prove far-reaching in the practice of pneumonia prophylaxis and treatment. More attention will be given to the future treatment in hospitals where laboratory facilities are conveniently at hand. The tendency in the cities and towns will be for the general practitioner to transfer pneumonia patients immediately to the hospitals when it is possible to do so. As for the country doctor, situated remote from medical centers, the question, what shall he do? is a most interesting subject.

A general practitioner from the country district may well ask: "How is a physician engaged in country practice and not provided with proper laboratory facilities to determine whether his patient has a pneumococcus pneumonia or a streptococcus pneumonia, or is suffering from a mixed infection?

"You advise the country physician to send a specimen of sputum to a medical center for bacteriological diagnosis. This advice I do not consider of much value. Pneumonia is a treacherous and uncertain disease. A patient may be taken mildly ill with every reasonable expectation of recovery, yet may die suddenly and unexpectedly. If the doctor is forced to wait two or three days for a bacteriological diagnosis, the chances of recovery from a serious disease, that in its usual course terminates in from five to nine days, are reduced to a minimum.

"You say that the fundamental principle of treatment, in the light of present knowledge, is to inject promptly anti-pneumococci serum intravenously in all cases of pneumococcus pneumonia, whether mild or severe, and give doses sufficiently large early in the treatment of the case to destroy completly the infecting microorganisms and neutralize their poisons. But how is the general practitioner, located in the country remote from medical centers, to know whether his patient has pneumococcus pneumonia or not?

"You also tell me that there are several types of pneumococcus; also, that there are several types of streptococcus; therefore, there are several types of pneumococcus and streptococcus pneumonias. Should a specific serum be used for each type of pneumonia? Or is the proper procedure to give the patient a polyvalent antipneumococcus serum, and a polyvalent antistreptococcus serum conjointly?

"I confess that the condition of my mind seems to be one of confusion worse confounded."

The dilemma of the country practitioner is typical of that of many practitioners in country practice all over the land. What can the American Therapeutic Society do to aid the country doctor in this dilemma? As an aid to the discussion of the subject, a brief review of some points in regard to the etiology and treatment of the pneumonias, resulting from researches in this country and abroad, may prove serviceable.

We are indebted to Avery, Chickering, Cole, and Dochez for their researches conducted at the Rockefeller Institute, which have demonstrated that at least three types of the pneumococcus cause pneumonia. Furthermore, pneumonia may be caused by several other kinds of microorganisms, as we all know.

The pneumonias caused by Types I, II, and III, including group IV which possibly includes twelve or fifteen other types, vary in frequency, in severity, and in response to serum treatment.

In regard to the incidence of various types of the pneumococcus and the resulting mortality, the following table and explanatory statements are taken from the "Monographs of the Rockefeller Institute for Medical Research," No. 7, page 733.

Incidence of Various Types of Pneumococcus and Resulting Mortality.

Type of Pneumococcus	Incidence, per cent.	Mortality, per cent.
I	33	25
II	31	32
III	12	45
IV	24	16

"The statistics given in the above table approximate the facts as closely as they can be ascertained at the present time. Organisms of

Type IV have in our experience been found to possess the lowest virulence of the different types for human beings. Type III pneumococcus, although it is the cause of the smallest percentage of cases, nevertheless gives rise to a high mortality and the outlook for a patient infected with Type III pneumococcus is comparatively bad. Pneumococci of Types I and II are responsible for about 64 per cent. of all cases of lobar pneumonia and are of relatively high virulence for man, the largest number of deaths in lobar pneumonia being due to these organisms. The mortality in Type I infection is 25 per cent. and in infections with Type II pneumococcus about 32 per cent. These two types together are responsible for approximately 62 per cent. of all deaths from lobar pneumonia. It is evident, therefore, that the outcome of any case of lobar pneumonia is influenced by the type of organism with which the individual is infected, and knowledge of the type of pneumococcus causing the infection is therefore of value in prognosis. It must be borne in mind, however, that there is considerable variation in the severity of the individual cases due to the different type of pneumococcus."

The following editorial statement occurs in the department of therapeutics, *Journal of the A. M. A.*, Feb. 9, 1918:

"The serums against infection with Type I organisms appear to have produced especially good results, and to be highly effective in treatment of cases of pneumonia due to its type of organisms. The serum of Type II is much less efficacious and, indeed, it has not yet been thoroughly demonstrated whether it has any valuable effect on the outcome of disease. The serum for Type III organisms has apparently but slight therapeutic power and has not been considered worthy of use in infections with this organism. The same is true of infections with Type IV pneumococcus. Commercial preparations of these serums are available and also polyvalent serums. These polyvalent antipneumococcus serums are of extremely doubtful value. It has been suggested that polyvalent serum be given until the type of the organism is determined, and that following this the specific serum for Type I or Type II may be utilized if the infection proves to be of that character. . . . It has also been suggested that every pneumonia patient receive, immediately after being taken to a hospital, a large dose of antipneumococcic serum of Type I, with the idea that the case may prove to be of that character and considerable time will be gained. . . . The serum treatment of pneumonia with Type I serum is quite likely to be harmful because the intravenous injection of 100 or more cubic centimeters of horse serum can hardly be devoid of harm, and is certainly not to be used except when very decided benefit may be expected to follow its use."

I am calling attention to the latter statement because the editorial writer was evidently not posted in regard to the chemical composition of antibacterial serums in general. Polyvalent serum and Type I serum are practically identical, the only exception being that the former contains antibodies against Types I, II, and III pneumococcus and the latter antibodies to Type I only. Moreover, polyvalent serum contains the same amount of antibodies against Type I pneumococcus as Type I serum.

Polyvalent serum, therefore, if properly prepared, has exactly the same specific action against Type I infection as Type I serum has, and it also possesses immunizing properties against the other types of the pneumococci, in so far as the antibodies against these types are effective in combating Types II and III. It is true that whenever any one of these serums is employed "100 or more cubic centimeters of horse serum" are injected. But the writer of whom the editorial speaks, advises routine injections of Type I serum before waiting for type diagnosis, and, therefore, advises the injection of "100 or more cubic centimeters of horse serum" containing antibodies against Type I pneumococci, before waiting for type diagnosis. The advice in regard to the immediate use of serum treatment without waiting for type diagnosis, for the purpose of saving time, is good advice, and if the physician uses polyvalent serum containing antibodies against Types II and III, pneumococci, he is not only following that advice, but he is possibly giving his patient even better service than though he had only injected Type I serum. In either case he is forced to inject "100 or more cubic centimeters of horse serum" for he cannot administer the required dose of antibodies without so doing, whether he uses Type I serum or the polyvalent product.

Both Type I serum and polyvalent serum are being supplied by the large producers so that physicians may take their choice between them. There is no special reason why the producers should prefer to advocate the use of either one in preference to the other. The choice lies with the physician, but it would seem to me more logical to use standardized polyvalent serum than the Type I serum.

In the opinion of prominent army surgeons, with whom I have talked, the use of polyvalent serum possessing antibodies to Types I, II, and III, serves a better purpose than the employment of Type I serum, because it produces more or less immunity to re-infection.

Owing to the fact that observations of these army men were imparted to me in confidence and have been incorporated in their official reports, which are in the hands of the Surgeon-General, and which have

not yet been published, I am, of course, not permitted to use their names.

But, in the light of recent reports received from Fort Sam Houston, Camp Travis, Camp Oglethorpe, and other army posts, it is far more important to find out whether the patient is the victim of pneumococcus or streptococcus pneumonia, or is suffering with a mixed infection, than it is to determine the type or types of organism responsible for the condition.

Fortunately, it is not necessary for the country doctor to secure a bacteriological diagnosis before resorting to serum or vaccine therapy in the treatment of pneumonia. Nearly all that can be obtained from serum treatment is possible to secure by conjoint use of polyvalent anti-pneumococcus and antistreptococcus serums. Accuracy in diagnosis and treatment may require laboratory facilities, but the country doctor, who is not in a position to avail himself of such service, need not let his patient die for the want of it. The most important thing to remember is the necessity of prompt action and the use of large initial dose (100 c.c.) and repeated injection, for the purpose of destroying the infecting microorganisms, neutralizing their toxins, and keeping the blood sufficiently loaded with antibodies to prevent reinfection.

The Serum Treatment of Streptococcus Pneumonia.—Now in relation to the serum treatment of streptococcus pneumonia, the light shed on the subject by the researches carried on at the Base Hospital, Fort Sam Houston, San Antonio, Texas, is quite illuminating.

The first report of these researches appeared in the *Journal of the A. M. A.*, April 13, 1918, in a paper entitled "The Pneumonias: Streptococcus and Pneumococcus Groups," contributed by James G. Cumming, M.D., Major; Charles B. Spruit, M.D., First Lieutenant, both of the Medical Reserve Corps of the United States Army, and Charles Lynch, M.D., Colonel, Medical Corps, United States Army and Department Surgeon. This report followed a conference of medical officers from Fort Sam Houston and Camp Travis, held Jan. 13, 1918, for the purpose of considering the pneumonia situation. Various points in the determination of the causative organism in pneumonia following measles were considered, methods of procedure were suggested, and the laboratory force was organized to take up the work. A preliminary report was sent to the Surgeon-General of the United States Army, Feb. 7, 1918. The paper contributed to the *Journal of the A. M. A.* consists of a part of the original report, together with additional cases and comments.

Of patients with pneumonia following measles, 28 blood specimens in all were tested. Of these, 24 were negative while 4, or 17 per cent., were positive for hemolytic streptococci. In the series of necropsies re-

ported, a much larger percentage of the specimens were positive. Of the 61 examinations of pleural exudates from patients in the pneumonia wards, organisms were found in 48 specimens. Of 41 lobar pneumonia specimens, 59 per cent. proved to be pure streptococcus, and 41 per cent. pneumococcus. Of 7 bronchial pneumonia specimens, 86 per cent. were streptococcus, and 14 per cent. pneumococcus. By consolidating these two groups, the authors found that 63 per cent. were hemolytic streptococci and 37 per cent. pneumococci. In the 31 necropsies, streptococci were isolated from 21 lung specimens, 22 pleural exudates, 14 pericardial exudates, and 15 hearts' blood specimens. The streptococcus was isolated in each of the 24 bronchopneumonia cases. Of these 24 cases, 18 or 75 per cent. are known to have followed measles. In only one necropsy on a patient that had had pneumonia following measles was a type epidemic pneumococcus found, and this was coexistent with the hemolytic streptococcus; while in the 7 lobar pneumonia cases, hemolytic streptococci were found, either in pure culture or coexistent with pneumococci, in 5, or 71 per cent., of the necropsies.

The authors state: "It would appear that the hemolytic streptococcus was the cause of death in 29, or 94 per cent., of the 31 cases of lobar pneumonia included; and since this organism was found in entirely pure cultures in all lung specimens, as well as in pure cultures in either serous exudates or the hearts' blood or both, in cases of pneumonia following measles, it may be concluded that the hemolytic streptococcus is the causative organism in this complication following measles; moreover, that it was the immediate cause of death in a large percentage of the so-called lobar pneumonia cases."

The authors conclude that on account of the unquestioned prevalence of streptococcus pneumonia, both as a complication of measles and as coexistent with lobar pneumonia, it is apparent that a new differential procedure for type identification must be devised. In none of the lobar pneumonia cases which at necropsy showed both pneumococci and streptococci, had an ante-mortem diagnosis of type epidemic pneumococci other than Type IV been made.

Because streptococci were found in 55 per cent. of the cases, because mortality from infection by the streptococcus is high in the so-called lobar pneumonia cases, and because the streptococcus has not heretofore been recognized as an important factor in the pneumonias, the authors consider the identification of this organism in the sputum of great importance in determining the proper therapeutic treatment and say that some of the failures of the antipneumococcic serums in the treatment of lobar pneumonia are doubtless due to the hemolytic streptococcus. Therefore they advise that a specific antistreptococcus serum

of a high titer be applied to both groups of pneumonias, believing that this will be the most effective agent in reducing the high mortality.

The results of the researches of Cumming, Spruit, and Lynch at Fort Sam Houston, were verified in essential particulars by the report of the commission sent by Surgeon-General Gorgas to Texas in February to study the pneumonia existing there.

This commission was composed of Drs. Rufus Cole, W. G. MacCallum and Oswald T. Avery, Contract Surgeons, United States Army, Captains A. R. Dochez and R. A. Kinselle, and Lieutenants F. G. Blake, T. M. Rivers, H. John, F. A. Stevens and William C. Von Glahn, Medical Reserve Corps. This especial study was undertaken at the Base Hospital, Fort Sam Houston, which was chosen for this work merely because pneumonia was prevailing there to a large extent at the time, and also because of its proximity to the laboratory of the Southern Department, where facilities were available for carrying out the bacteriological and pathological examinations. This report appears in the *Journal of the A. M. A.*, April 20, 1918, page 1146. It is entitled "Pneumonia at a Base Hospital." Part I deals with the etiology and clinical features of the pneumonia occurring in the hospital and was contributed by Dr. Cole. Part II deals with the pathology by W. G. MacCallum. The researches of the commission bring out many of the points concerning the bacteriology of the pneumonias occurring in the paper of Cumming, Spruit, and Lynch, already referred to. It was observed that pneumonia occurred frequently in the camp, but not always as a sequel of measles; that the coryza, conjunctivitis, and laryngitis produced by measles appeared to predispose to infection of the respiratory tract with bacteria; that streptococcus infection might occur in a person who had not had measles, and it is quite probable that other diseases, such as scarlet fever, predispose to it in the same way as measles. MacCallum says, "When *Streptococcus hemolyticus* gained a foothold it usually caused in this series of cases the anatomic complex called here 'interstitial bronchopneumonia.' This is the same whether it is preceded by measles or scarlet fever, or by other diseases, and its characters are due to the specific effects of the streptococcus. When lobar pneumonia followed measles, the pneumococcus was in this series accompanied by the streptococcus, and in some cases the lobar pneumonia was complicated anatomically, by the corresponding bronchopneumonia."

It was also observed that infection with the hemolytic streptococcus does not always cause an interstitial bronchopneumonia, but may produce a patchy lobular pneumonia.

The author states that "one of the most interesting features of our study of the cases in this hospital is the recognition of the invariable

connection of *S. hemolyticus* with that characteristic anatomic lesion which was well known, but to which we have for convenience given the name 'interstitial bronchopneumonia.' * * * Empyema is a practically constant accompaniment of this condition and is of extremely serious import."

The report also states that "lobar" pneumonia due to pneumococcus has been found in many cases, not especially related to the occurrence of measles, but often complicated by secondary or coincident infection with *S. hemolyticus.*

One of the latest contributions to the bacteriology of the pneumonias is the report contributed by George F. Dick, M.D., of Chicago, and published in the *Journal of the A. M. A.* for May 25, 1918. It is entitled "A Bacteriological Study of the Pneumonia Occurring at Camp Pike, Arkansas." The study is based on sixty cases of pneumonia admitted to the base hospital during February and March. The evidence obtained by examination of the sputum was further substantiated in a number of cases by bacteriological examinations of the blood during life and of the lungs after death. This report confirmed the statements of the other investigators quoted in relation to the frequency of the streptococcus as an etiological factor in pneumonia.

The pneumococcus cases form 48 per cent. of the 60 cases studied; of these 21 per cent. were Type I, 34 per cent. Type II, and 45 per cent. Type IV. Only one case of Type III was observed.

In 46 per cent. of the cases streptococci were the predominating organisms; of these 46 per cent. were non-hemolytic. In the cases coming to necropsy the pneumonia in which this type of organisms was found resembled the ordinary pneumococcus lobar pneumonia.

As stated by the author, his series of cases is interesting on account of the high percentage of streptococcus infection particularly due to the non-hemolytic organisms, which were also found associated with cases diagnosed as influenza and in the pus from appendicitis.

Vaccine Treatment of the Pneumonias.—You will doubtless remember that in 1912 Sir A. Wright undertook some investigations for the purpose of testing out the value of bacterial vaccines in the prophylaxis and treatment of pneumonia. These investigations were carried on in the South African gold and diamond mines. At this time the existence of definite groups of the pneumococcus, distinct and possessing specific immune reactions, had not been definitely proved, so it is not known what groups of the pneumococcus were included in the vaccines he used. However, as pointed out by the *Lancet,* April 13, 1918, the results of these investigations were valuable as the remarkable reduction in the mortality of pneumonia among the native mine-workers fully demonstrated.

Mr. F. S. Lister, bacteriologist of the South Africa Institute for Medical Research, who independently worked out the differentiation of pneumococci into several distinct groups by a means of immune reactions (Publication 2, South Africa Institute of Medical Research, 1913), found that the pneumonia prevalent among the workers in the diamond mines at Kimberley, South Africa, is due, mainly to three groups of pneumococci. (Publication 10, South Africa Institute for Medical Research, 1917.)

The *Journal of the A. M. A.* for April 20, 1918, page 1163, informs us that Lister found that "three subcutaneous inoculations with the triple vaccine of the three groups prevent the occurrence of pneumonia as caused by members of these groups, but not the pneumonia due to other groups of the pneumococcus." From seven to ten million of pneumococci were given at each injection, the cocci being first killed by a germicide and not by heat.

The fact that Lister has apparently succeeded in preventing pneumonia caused by the pneumococcic groups of which his triple vaccine was made, is certainly worthy of serious consideration. "The suggestion lies near at hand that prophylactic inoculation with the prevailing groups of pneumococci should be given a thorough trial where susceptible persons are aggregated under conditions that usually cause the outbreak of pneumonia."

Lister found that his own serum, following vaccination, contained agglutinins and opsonins, against the type of organism injected, eight months after the last inoculation.

Cumming, Spruit, and Lynch, to whose report I have already referred, consider it advisable to vaccinate measles patients found to be hemolytic streptococcus carriers, and also advise vaccination against the streptococcus irrespective of measles patients, beause the hemolytic streptococcus is of such universal prevalence, they believe that such universal vaccination would protect against the infection and if this procedure is carried out the case rate, as well as the mortality of the pneumonias, both pneumococcus and streptococcus, would be reduced by a large percentage. They suggest the use of a triple vaccination for this purpose, consisting of the hemolytic streptococcus and pneumococcus Types I and II.

Dr. E. C. Rosenow, of the Mayo Foundation, Rochester, Minn., reported results in the treatment of 200 cases of pneumonia with a partially autolyzed pneumococcic vaccine. In his report published in the *Journal of the A. M. A.*, March 16, 1918, he recommends that a polyvalent vaccine prepared in this manner be injected in all cases of lobar pneumonia as soon as the diagnosis can be made.

Mixed vaccines were opposed for a time by some of the specialists in vaccine therapy, also the use of stock vaccines, but more recent investigations have removed much of the prejudice. Dr. Aldo Castellani, Regius Professor of Tropical Medicine, University of Naples, and for some time in the British colonial service in Ceylon, as director of the Clinic for Tropical Diseases and Bacteriological Institute, was one of the first to emphasize the importance of mixed stock vaccines. For a number of years he advocated the mixed vaccine of typhoid and paratyphoid A and B. Not only did he advise the use of mixtures of typhoid and paratyphoid, but also suggested the addition of the microbes causing cholera, plague, and Malta fever. He furnished data to show that agglutinins developed in the serum as a result of the inoculation of such mixed vaccines were not less than when the vaccines were given separately. ("Some Recent Vaccine Therapy," by Alex. Fleming, F.R.C.S., *Practitioner,* April, 1917, page 322.)

In a private communication, dated Sklopje, Serbia, August 23, 1915, Dr. Thos. W. Jackson, a member of the commission appointed for the extermination of typhus fever in Serbia, referred to Castellani's "tetravaccine" (cholera, typhoid, and the paratyphoids) and said that it had been adopted by Dr. Richard P. Strong of the commission and also by the Serbian government. Dr. Jackson stated that more than 120,000 doses of this vaccine had already been administered without harmful results.

McCoy, in a paper appearing in the *Journal of the A. M. A.,* speaks in favor of mixed vaccines in typhoid fever. He says combined vaccines consisting of the typhoid bacillus, the two paratyphoids, the dysentery bacillus, and sometimes the cholera vibrio have been used to some extent. "There appears to be justification for the use of such combinations as preventives under special conditions."

Sir Almroth E. Wright has strongly advocated and applied a mixed "asepsis vaccine" prepared from mixed cultures for vaccination against mixed infections occurring in the wounded. According to the latest information at hand, half a million doses have been administered.

By means of the Abderhalden test, Smith demonstrated in the Mulford Laboratories that specific antibodies for each of a number of varieties of bacteria are formed as a result of the inoculation of a mixture of the microorganisms employed, namely: *Staphylococcus aureus, Staphylococcus albus,* streptococcus, pneumococcus, *Bacillus influenzae* and *Micrococcus catarrhalis.*

Now mixed typhoid and paratyphoid vaccination is almost exclusively practised in the army, and mixed vaccines for immunization against various mixed infections and for their treatment are quite in

vogue. So it did not come to us with as much of a surprise when the above reports recommending mixed vaccines for immunization against pneumonia appeared. Nor were we surprised when one of our members, Dr. S. Solis-Cohen of Philadelphia, in a paper read before the Philadelphia County Medical Society, March 13, 1918, said that at Fort Oglethorpe he had become conversant with the work of Capt. Arthur Dare and Dr. D. H. Bergey, assistant chief of the laboratory, who had put into execution at the hospital the treatment of pneumonias with a mixed vaccine and in more than a hundred cases of lobar pneumonia treated with this vaccine the death rate had been less than 6 per cent. (See Report Symposium on Pneumonia, *Medical Record,* April 27, 1918, page 743.)

In the light of the above evidence and more of the same kind that might be presented if the time limits of this paper would permit, what advice shall be given the country doctor relative to pneumonia treatment without bacteriological diagnosis? In response to this question I have received the following answers:

1. Use antipneumococcic and antistreptococcic serum conjointly, employing the polyvalent serums, assuming that the patient is probably suffering with a mixed infection.

2. Use a polyvalent vaccine made from as many strains or types of the pneumococcus and streptococcus as it is possible to obtain. Preferably employ a sensitized vaccine, because the first step in the immunizing process has already been accomplished outside of the patient's body; therefore the immunizing response is more rapid and complete; moreover, there is less likelihood of severe reaction.

3. Use both serums and vaccines in the treatment of the same patient.

4. An original suggestion of my own: Have a serum prepared by immunizing horses against mixed cultures of pneumococcus and streptococcus. I presented this suggestion to one of the best known producers of biological products engaged in the preparation of serums and was informed that the preparation of such a serum was already under way.

11 West Philellena Street.

DISCUSSION

Dr. Thomas F. Reilly of New York City said that Dr. Stewart's presentation was an excellent summary of the literature of the serum treatment of pneumonia. Last winter in the Fordham Division of Bellevue and Allied Hospitals a fairly extensive use of the serum was made. It was impossible to have a special examination made for the differentiation of the different types, because the technician had gone to war and it would involve the constant use of a messenger both day and night to have the work done at the Main Laboratory, so for a period all cases of pneumonia entering the Hospital were injected with antipneumococcus serum, com-

bined types 1 and 2 of New York City Department of Health. Of 78 patients so injected 8 died—3 of these died within 12 hours—and 50 per cent. of the cases that died had severe kidney and heart lesions. They were the flotsam and jetsam of New York City and usually the pneumonia mortality among these approximated 30 per cent. During the epidemic because of the inability to get the serum and as a means of checking up non-treated cases, 31 cases were not treated with serum. Of these, 8 died. Usually 60 c.c. were given on the entrance of the patient into the hospital and from 60 to 80 c.c. every 12 hours thereafter. It was the impression, aside from the statistical results, that the serum was of distinct service in the treatment of pneumonia, even though one did not differentiate between the different groups of pneumococci. It was customary to give ½ c.c. under the skin one hour before using the serum intravenously for the first time in order that they might determine the presence of anaphylaxis. There were a few anaphylactic reactions, such as urticaria, arthritis, etc., but none of them were severe. This pneumonia was the ordinary type of pneumonia, such as one sees in practice—lobar in character—and without any bronchopneumonic symptoms. The speaker could not see wherein a *vaccine* could be of any service in the treatment of pneumonia, except as a prophylactic.

Dr. Ernest Zueblin of Cincinnati said he certainly appreciated these papers, but if it became necessary to enforce the giving of typhoid vaccine to all of the civil population, there was a certain amount of danger that should not be overlooked. Quite a considerable number of cases could be quoted in which active pulmonary tuberculosis followed immediately phophylactic typhoid vaccination. Furthermore, it was to be regretted that so little weight and consideration was given by military surgeons to the authentic statements of professional men of good standing attesting the successful prophylactic typhoid vaccination shortly before enlistment. Notwithstanding these statements nurses were revaccinated, and in one instance a severe septicemia was the result, which almost killed the formerly healthy nurse. In regard to pneumonias, it was very desirable that those should be classified according to the characteristic causative microorganism since the classification according to the pathological anatomy was frequently found incomplete.

Dr. N. P. Barnes of Washington, D. C., said that certainly no class of cases gave a better excuse for a death certificate than these multiple pneumonias. People were beginning to excuse the profession if their friends did not get well. The Frenchman said "au revoir," the Irishman said "pneumonia, pneumonia." The profession was coming to the serum treatment. He would like to give personal experience in regard to the dosage. One hundred c.c. of horse serum intravenously was considered the dose, but it was well to test the patient before a large dose by giving a subcutaneous injection and watching the urticarious effect on the skin. The time of operation in these lesions was of the greatest importance. The temperature would be a good guide in such cases; at a certain point of clearing up of the pleural cavity, it came down, and this might be the best time for relieving the pus pressure. Too early operation was contraindicated. He would be glad to hear other opinions as to the best time of operation.

Dr. Jacob Diner of New York said he could fully sympathize with Dr. Babcock about the material that was being sent to camp. But, as a member of the Medical Advisory Board, he had to hide behind the instructions received from Washington. Specific infections were not allowed to be a bar to active service, whether with a plus Wassermann, or with local lesions. The man with Neisser infections had to go into the army. In fact every man with the usual number of arms, legs and eyes

had to go into the army. They had all been much instructed by the president's paper. He thought sera and vaccines were now being adopted by most surgeons.

Dr. G. R. Satterlee said he would congratulate Drs. Hitchens and Stewart. Dr. Hitchens was launching wonderful work against the *Streptococcus hemolyticus* infections. Dr. Satterlee said he had tried the streptococcus antiserum against infections in other parts of the body, particularly where there was bacteriemia. He had not, however, seen any case really benefited by this vaccine, but this was a field for much future study. He had not had personal experience with the pneumococcus vaccine but he had heard Dr. Cecil's remarks at Albany. His streptococcus percentages were higher at Camp Upton than they were in Rhode Island. Dr. Cecil inclined to the idea that the streptococcus was an end infection and that a certain amount of cross immunization was obtained by streptococcus vaccination, against both streptococcus and pneumococcus pneumonia.

Dr. R. T. Morris of New York said he had had a patient, a young married woman, a fine, strong physical type, about to go on a motoring trip with her husband. She had a rapidly developing tonsillar infection and began to feel weak and ill. The right tonsil showed a streptococcic infection which was treated by argyrol locally. The young woman died in 3 days and a culture made from the tonsil showed *Streptococcus hemolyticus*. Dr. Morris wished to know if any of the members considered if he could have done anything with vaccine in such a case?

Dr. Lewis H. Taylor of Washington, D. C., asked if acroflavine was used or dichloramine-T; how did it compare with Dakin's results?

Dr. E. Zueblin of Cincinnati said he would like to know what observations were made on the tappings of the fluid. This opened a new field for discussion. The action of the Dakin solution on the lung tissue had not yet been observed.

Dr. H. B. Anderson of Toronto, Canada, asked if anyone present had any experience of the effect of vaccine on the severe type of pneumonia, such as described by Dr. Morris. In Toronto there had been this spring the most virulent type of the disease he had ever seen. One patient he had seen died in 24 hours, another in 48 hours; this was a common experience. He had used vaccine in those chronic infections associated with heart trouble, but had not seen any benefit result from their use. He would like to know what result there was from the free opening of the pleural cavity, where there was no walling off by adhesions. Was there any danger of collapse of the lung?

Dr. Babcock said that in regard to spinal puncture in meningitis he was much impressed by results obtained in brain tumor and fracture of the skull with compression of the ventricle. On aspiration there had been jamming down of the foramen magnum, with death. In meningitis there was effusion into the lateral ventricle, which played an important part in the symptoms. He would hesitate to draw fluid from within the brain and ventricle, which might end in jamming the brain down so as to cause death. In one case at Camp Beauregard, the patient was apparently dying of spinal meningitis with symptoms of ventricular distention. The needle withdrew 100 c.c. of turbid fluid and meningitis serum was injected. The patient recovered. In Cushing's cases of effusion into the ventricle, the patient was supposed to be dead. They withdrew the fluid from the lateral ventricle from a subtentorial tumor, and the patient lived for a while. The important thing was to prevent death from ventricular distention. In regard to dichloramine-T—it caused discharge and progressive healing. The destructive action of the solution on the pleura had not been noted. Granulation tissue and adhesions had occurred. There was no effect on the lung whatever. The solution had to be exactly according to

the formula of Dakin. Every batch made had to be tested A degree too much alkalinity caused irritation. It it gave pain or caused trouble there was something wrong. The danger of lung collapse, if the tubes were properly introduced was very rare. The fluid should be drained off slowly so as not to disturb the heart. In regard to Dr. Barnes' point, as to time of operation, too early operation was not indicated. Some patients had great big walled-off cavities with the lung completely collapsed. These cases had a high mortality.

Dr. Hitchens said that the question of ill effects of typhoid vaccination had been answered by Col. Russell. Instead of being likely to be followed by tuberculosis. it was found that after typhoid vaccination, the incidence of tuberculosis in the army was less than before. Such cases as did happen, were assumed to be coincidence. If the nurses had septicemia following typhoid vaccination, there was some slip in the technique. Someone was at fault. They should not have had it. As to whether this procedure should be recommended in civil life—if there was a good water supply and very few flies, there was practically no typhoid in the community and there was no use in doing unnecessary work. But with contrary conditions, typhoid prophylaxis should be insisted upon. In former years, ten per cent. of the soldiers contracted typhoid. It was practically non-existent in the army to-day. In regard to anaphylaxis, Dr. Stewart would answer that question. Victor C. Vaughan had been studying the question of pneumonia in the various camps and had found a law in regard to the incidence of death rate from pneumonia. Pneumonia in the tropics was a very serious disease and it was more prevalent in the South than in the North. A vivid picture of conditions was presented by two southern camps, only 200 miles apart, showing different mortality and morbidity rates. This difference was based on the communities from which the boys came. The rates were, however, lower than they were in the cities from which they came. It was found that there was a variation in the death rate according to the situation in relation to the Mason and Dixon line and the Missouri River. North of this line the death rate was lower; south of it, higher. If the boys came from Florida and Georgia, the incidence of pneumonia was high. In one camp the negroes came from families who had been north for two or three generations. The death rate was no higher than for white boys, and not so high as for the white troops from the South. Col. Vaughan went back to the statistics of the Civil War and found that the death rate was 18 per thousand per year for the Northern troops, and 63 per thousand per year for the Southern troops. Therefore, it was found that the further south the location, the greater the virulence of the disease. Although the immunization against pneumonia lasted but a few months, it was believed to be well worth while.

Dr. Stewart said he would like to answer Dr. Morris. He thought that 100 c.c. of antiserum could have been employed with advantage in the case mentioned.

THE RELATIONSHIP OF ORAL SEPSIS TO SYSTEMIC DISEASE, AND ITS BEARING ON TREATMENT

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Based on clinical observations and investigations carried on during the past few years, I believe it may be stated that "oral infection" is the most important problem before the medical and dental professions at

the present time. For years we have recognized in a vague way its serious possibilities. More intensive interest and investigation were stimulated by the writings of William Hunter on its relationship to pernicious anemia. Until the past three or four years, however, attention was centered more on pyorrhea, dental caries, and other more obvious manifestations of oral sepsis, overlooking the fact that the greatest danger was not from these but rather from apical or root infections. The devitalizing of teeth and the sealing up of infection by fillings, or under crowns and bridges, permits the development of serious pathological conditions, with neither symptoms nor obvious signs of the danger menacing the patient's health. In fact, it was frequently those patients who tried to be most careful, who visited the dentist most faithfully, and who had the most extensive and expensive mechanical dentistry carried out, who got into the most serious trouble.

The dental profession, to its credit, has been foremost in warning of the dangers in these cases. This no doubt is partly due to the fact that they were more familiar with the faults and deficiencies of dental technique, and in their routine of work had the best opportunity for observing bad local results.

It is easy to be wise in retrospect, and while evidence as yet does not warrant conclusions, still it is sufficiently suggestive to open a wide field for observation and investigation of the causes for the undoubted increase in certain diseases coincident with the development of mechanical dentistry. The frequency of severe grades of anemia, appendicitis, gastric and duodenal ulcer, gallstone disease, exophthalmic goiter, arterial hypertension, and even diabetes, has been so striking as to call for comment on the part of the laity. In what measure has oral sepsis been responsible for this increase? Sufficient data are not yet forthcoming to answer this question definitely, but they are at least so striking as to call for the fullest investigation.

The removal of teeth is a serious matter, interfering with mastication, and consequently with the kind of food the patient can eat, and, as a result, with his digestion and nutrition. The shock, the opening up of fresh areas for the absorption of pathogenic bacteria and their toxins, involved in the removal of large numbers of infected teeth, especially in the old, the debilitated, and in cases of acute systemic infection, are matters for serious consideration. I have seen two cases of cardiac disease with generalized infection by the *Streptococcus viridans,* evidently due to oral infection, in which death followed and was apparently hastened by extraction. Only a few days ago I saw in consultation a patient practically moribund with acute pneumonia who had been operated on three days previously for a small epithelioma in the floor of the mouth. He was a vigorous railway man, 46 years of age,

had never been seriously ill, and the operation was considered trifling. He had marked oral sepsis, and the surgeon extracted some half dozen of the worst teeth in the upper jaw. The patient died on the third day, and cultures from the tooth sockets and the operation wound showed *Streptococcus viridans* and a diptheroid bacillus, and from the lung a pure culture of *Streptococcus viridans*. The blood culture was sterile.

Some years ago a patient, Hebrew, about 30, was admitted to St. Michael's Hospital, under my care, suffering from an illness which followed extraction of a tooth a few days previously. He had a temperature of 102°, but did not seem seriously ill. In a few days he developed a widespread purpura, hemorrhages from the stomach, bowel, and kidneys, and died in a week.

Suppuration of infected cervical glands occasionally follows extraction. The removal of unerupted teeth, especially, is often a difficult and serious procedure.

I bring these points forward, not as arguments against extraction for the relief of infection, but that it should be undertaken with due care and appreciation of serious possibilities.

Our experience with oral sepsis appears to be, in some ways, another example of the remarkable limitation of human observation and reasoning in regard to what, studied in retrospect, was a very common and obvious cause of disease, as evident as the infectiousness of tuberculosis or the symptom group of Graves' disease, or appendicitis.

In devitalizing teeth, buttressing up infected teeth which should have been extracted, sealing up infection under crowns and bridges, improperly filling root canals, or not filling them at all, incautiously using strong antiseptics, such as arsenic, or causing injury to tissue by direct trauma, dentists were violating scientific principles and thus treading on dangerous ground.

While there are valuable signs presented by ordinary local examination suggestive of root infection, yet in many cases these are insufficient for diagnosis even by skilled and experienced dentists and physicians. X-ray examination is of great value, but even this may fail. Expert radiologists frequently differ in their interpretation of *x*-ray films and their clinical significance. The *x*-ray may show rarefaction, but this does not say whether there is an active infection, or whether it is altered tissue where the infection has died out, any more than it can say with certainty whether a lung shadow is that of an active or a healed lesion. Other clinical evidence must be taken into consideration.

We must remember, on the other hand, that at an early stage of infection the bony and other tissue changes may escape detection by the *x*-ray, as they do in early osteomyelitis affecting the long bones;

and that the *x*-ray shows the *minimum* rather than the *maximum* amount of trouble.

The angle at which the picture is taken and the overhanging margin of the antrum, present well-known practical difficulties in *x*-ray diagnosis.

In the mouth of the sick individual containing devitalized teeth, crowns, bridges, pivot teeth, etc., my own experience bears out the *presumption of infection* rather than that of its absence. Every tooth, therefore, should be examined.

A sweetish, offensive breath, swelling and local purplish-red color of the gums, the unusual prominence of certain sockets beyond the general contour of the alveolar margin, the presence of dark teeth, the escape of blood and pus on pressure, hypersecretion of the throat, tonsillitis, whitening of the mucous membrane of the mouth, and miliary enlargement of the lymph follicles beneath it, superficial ulcers, small fistulae about the bases of the teeth, etc., are points worthy of notice in directing further, and especially *x*-ray, examination. In some cases, however, in which the most careful local examination suggested no infection the *x*-ray has shown the presence of extensive trouble.

All patients with extensive or complete extraction of the teeth have evidently suffered from severe oral sepsis at some time.

The removal of the primary foci of infection, whether in the teeth or elsewhere, does not necessarily mean cure of the condition originally dependent upon such infection. The damage already may have been done, and we may be unable to repair it or to rid the system of infection which has thus gained entrance.

The patient's failure to improve, therefore, after an oral infection has been removed, does not mean that this may not have been the original source of trouble. One should never promise results, but take his stand on the ground that an infection in the mouth, as elsewhere in the body, should be cleared up, whether by conservative or radical means, depending upon the dentist's ability to deal with it. Such dental treatment, of course, should go along with the building up of the patient's health by appropriate general measures. This is a point which is too frequently forgotten.

The importance of trouble short of definite abscess formation, which the radiologist gets around by describing as "rarefaction of bone," "thickening of peridental membrane," etc., requires careful investigation. These are the most difficult cases to interpret and to appreciate their clinical significance. We all know that many cases, even with definite abscess formation, may go for a long time without producing evidence of systemic ill health. The latter depends upon the degree of systemic

resistance, the character of the infecting bacteria, and the number and extent of infective foci.

Rosenow has shown in his work on gastric ulcer that insignificant foci may be the starting point for general infection. To say that the local condition in rarefaction is due to the action of irritants, such as arsenic, or to traumatic causes, does not disprove the coexistence of infection; for such causes, by reducing the local resistance, predispose to it. We know regarding infection in general that the smallest point may be the port of entry. It is not, therefore, necessary to have many or large areas in order to produce serious systemic trouble in susceptible cases. Therefore, it may not be sufficient to remove only gross lesions—a single point may be sufficient in some cases. In many cases we fail to get the maximum benefit for our patients from neglect of this.

Considered from the viewpoint of general pathology, there is reason to believe that by increasing the patient's resistance many of the slight infections may be overcome. The periodicity of attacks in gastric and duodenal ulcer, gall-bladder, infections, arthritis, etc., with longer or shorter intervals of absence of active symptoms, where the primary focus of infection has not been removed, shows that it may have been at least temporarily overcome by increase of the patient's local and general resistance. "Apparently, the resistance of a large percentage of persons is sufficient to give full protection for years, yet we must ever keep in mind the insidious development of the secondary effects and then ask ourselves if we can be ever reasonably certain that one's health is safeguarded so long as there is definite evidence of infection in the mouth." (Black.)

Rosenow's work on infections has been of the greatest importance, in that it has helped to clear up and coordinate many previously disjointed and fragmentary observations and partial truths. I refer especially to what he says regarding transmutability of organisms and selective tissue affinity. We can now more readily understand why at one time an organism may produce root abscess or tonsillitis, gastric or duodenal ulcer, appendicitis, gall bladder infection, infective arthritis, etc., and therefore why these conditions are often interrelated and may have a common source of origin.

The recognition of the importance of this interrelationship of disease will have an important bearing not only on the prevention but the treatment of many diseases in the future. In all probability, it will reduce the frequency of operations, because it is obvious that if oral or other focal infections may cause gastric or duodenal ulcer, cholecystitis, appendicitis, or Graves' disease, in many cases our present surgical methods are attacking the problem at the wrong end, removing the

results rather than the cause. If the primary source of trouble remains, the removal of an organ or tissue secondarily infected does not go to the root of the pathological process.

In the preparation of this paper I have studied two hundred and fifty-seven private cases, all seen in office practice, of which I have full histories, and have been able to follow more closely and for a longer period than in hospital practice. They were patients naturally representative of a higher social grade than those found in hospitals. Minor degrees of oral sepsis are not included, owing to the difficulty of appreciating their significance.

I have tabulated these cases, noting the principal disease condition present and also other morbid conditions from which they suffered at the time of consultation or during the course of their illness. From the etiological standpoint this association of diseases is, I believe, of the greatest importance, and one which has not received the attention which it deserves. The frequent association of certain pathological or clinical conditions itself suggests an etiological interrelationship and not accidental occurrence. Autopsy experience impresses one strongly with the fact that pathological conditions found post mortem are usually so related. Clinical observation points the same lesson of a common causative factor, as noted in the complications and sequelae described in the systematic outline of various diseases. It is a clinical axiom that one should not predicate the existence of two or more unrelated pathological conditions if one is sufficient to explain the symptoms. The more frequently we find two or more pathological conditions associated the stronger is the *prima facie* evidence of their common origin.

Studied from this point of view, cases of oral sepsis present many interesting and instructive features. Various clinical and pathological interrelationships have been recognized for years, as tonsillitis and nephritis; tonsillitis and rheumatism; tonsillitis and appendicitis; tonsillitis and endocarditis, erythema multiforme, and chorea; appendicitis cholecystitis, gastric and duodenal ulcer; exophthalmic goiter, and diseases of the other glands of internal secretion, scleroderma, arthritis, etc.; Raynaud's disease, arthritis deformans, scleroderma, purpura, and urticaria; oral infection, tonsillitis, nephritis, and arterial hypertension in some instances.

Oral infections are usually of a low grade of virulence, sealed in, and extend over a long period. To study the evolution of such infections and to appreciate their various clinical manifestations they must be followed for a long time, the same as syphilis and tuberculosis. Private patients, therefore, offer a more favorable opportunity than hospital patients.

Another point I wish especially to emphasize is that if oral infection is shown to have a definite casual relationship to any one disease, as tonsillitis or exophthalmic goiter, it may also be, *per continuum,* the cause of other conditions of which the latter are known to be a starting point.

It is characteristic of oral infections that, as a rule, they do not produce a single systemic lesion, but a group of allied conditions, not all being manifested one at a time. This is shown by the diseases presented in my series of cases, as follows:

Classification of Diseases Associated with 257 Cases of Oral Sepsis

	Occurring Alone	Associated with Other Diseases	Total
1. Anemia	13	35	48
2. Gastric and duodenal ulcer, appendicitis, gallstones, etc.	22	25	47
3. Hypertension, albuminuria, kidney disease	27	36	63
4. Mucous colitis	2	3	5
5. Neuritis, lumbago, sciatica, etc.	27	47	74
6. Psychasthenia, nervousness, etc.	28	45	73
7. Raynaud's disease	1	4	5
8. Skin diseases	18	13	31
9. Tonsillitis	4	31	35
10. Goiter	5	22	27
11. Diabetes, miscellaneous	..	..	69
	147	251	477

The associated diseases were usually various groupings of the classes above mentioned.

Mrs. P.
Oral sepsis (the worst case I have ever seen).
Tonsillitis.
Rheumatism, sciatica.
Double antral suppuration.
Eczema.
Urticaria.
Nervous exhaustion.
Exophthalmic goiter.
Anemia, 70 per cent hemoglobin.

Mrs. D.
Oral sepsis.
Tonsillitis.
Migraine.
Raynaud's disease.

Miss L. V. C.
Oral sepsis.
Parotiditis.
Uveitis
Optic neuritis.
Double facial paralysis.
Secondary glaucoma.
Myocardial weakness.
Anemia.
Intermittent fever.

Miss U.
Oral sepsis (teeth all gone but 2).
Small goiter (Graves' disease).
Tonsillitis.
Laryngitis, bronchitis.
Hypertension, 170-120.

Anemia, 65 per cent hemoglobin.

Miss D.
Oral sepsis.
Tonsillitis.
Nervous exhaustion.
Cystic mastitis.
Rheumatic pains in chest.

Mrs. A.
Oral sepsis.
Tonsillitis.
Quinsy.
Appendicitis.
Neuritis.
Mucous colitis.
Neurasthenia.
Anemia.

Miss T.
Oral sepsis.
Tonsillitis.
Anemia, 70 per cent hemoglobin.
Hypertension, 165.
Erythema multiforme (nodosum et papulatum).
Sciatica.
Albuminuria.

Mrs. Ar.
Oral sepsis.
Chronic appendicitis.
Gastric ulcer (confirmed by operation).
Goiter.

Charles S. D.
Oral sepsis.
Tonsillitis.
Duodenal ulcer.
Sciatica, lumbago.

Miss Au.
Oral sepsis.
Anemia, 65 per cent hemoglobin.
Acne.
Membranous colitis.
Neurasthenia.

John L. B.
Oral sepsis.
Albuminuria.
Nervous exhaustion.
Arthritis (knees).
Sciatic neuritis.
Brachial neuritis (2 years ago).

Miss J.
Oral sepsis (staphylococcus aureus and streptococcus).
Tonsillitis.
Infective arthritis.
Raynaud's disease.
Erythema multiforme.
Anemia.

Mrs. A.
Oral sepsis.
Psychasthenia.
Colitis.
Sequelae of gastric ulcer.
Appendicitis.

Mrs. B.
Oral sepsis.
Cholecystitis.
Chronic interstitial nephritis.
Arterial hypertension.
Corneal ulcers.

W. R. D.
Oral sepsis.
Tonsillitis.
Appendicitis.
Arthritis (rheumatic, attack of fever).
Brachial neuritis.
Neurasthenia.

Mrs. G.
Oral sepsis.
Anxiety neurosis.
Infective arthritis (knees).
Mucous colitis.

Mrs. G.
Oral sepsis.
Tonsillitis.
Exophthalmic goiter, pulse 120-129.
Infective arthritis (knees).

Mrs. R.

Peripheral neuritis.	Oral sepsis.
Arterial Hypertension 160-115.	Eczema.
Lymphangitis, edema of legs.	Anemia, 60 per cent hemoglobin.
Cardiac decompensation.	Glossitis.
Arthritis (feet).	Pruritus.
Pleurisy (1916).	Exophthalmic goiter, pulse 120-150.

The above examples from my series of cases are typical pathological interrelationships met with. These various conditions did not, as a rule, appear at one time, but as phases of a long period of ill health, of which oral sepsis appeared to be directly or indirectly the cause.

Among the diseases before mentioned of which oral sepsis may be the cause there are some to which attention has not been so commonly directed, and which deserve careful observation and further investigation. Among these one may mention exophthalmic goiter, of which I have seen a number of cases where there was very conclusive evidence that oral sepsis was the cause of acute symptoms developing:

Case I.—Ida G. Sept. 7, 1917. Operator, Toronto Carpet Company; robust girl; 2 sisters have goiter, but no toxic symptoms. Patient also has had simple goiter for years. Three or four weeks previously patient complained of pains in upper dorsal region, general malaise, and fever up to 102°-103°. Since illness has been very nervous, emotional, and tremulous. Her mother volunteered the information that her illness followed the filling of a tooth that had been allowed to go too long; her face was swollen and tender after it. At time of my examination patient was exceedingly nervous and excitable; eyes glistening, but not protruding, marked tremor; pulse 120 to 130; gums about upper left molars were red, tender, swollen, and bled readily on pressure; tonsils were inflamed; large firm goiter, not tender; apex beat normal and heart sounds clear; no joint involvement. I suggested tooth as the cause of trouble, and Dr. Fawns had dentist drill it open, when a lot of pus was evacuated. Immediately temperature dropped to 99° and pulse to 88. The opening discharged freely, and she remained well for 5 or 6 days. One day she chewed some gum, which plugged up the opening. Immediately, temperature went up to 100° and pulse to 110. Tooth was then extracted, allowing free drainage, and temperature dropped, but pulse kept up as high as 120. This was afterward explained by the fact that patient was given 5 gr. thyroid extract in place of thyrodectin. As soon as this was discontinued she rapidly improved, thyroid decreased in size, nervous symptom disappeared, and on October 18 she was practically well. This might be considered as an experiment on the production of Graves' disease by oral infection.

Case II.—Mrs. P., age 36, first consulted me on Dec. 1, 1916, complaining of neuralgic headaches, mostly on left side; suffered from bad colds; numbness and heaviness on right side of body; attacks of urticaria; rheumatism; sciatica; was depressed and nervous. At time of examination, patient was pale, Hb 70 per cent., skin dry, tongue very coated, breath offensive; had chronic pharyngitis and tonsillitis; teeth very septic. Dr. McDonagh made *x*-ray examination and reported left upper second bicuspid. left upper cuspid, lateral and central, all septic, and left first bicuspid should be tested for vitality. There were sinuses opposite the left upper lateral and the posterior molars through which pus could be expressed by pressing on the left side of the roof of the mouth internally, and on the left side of the

nose; about the angle of the eye, externally. On removing the tooth the antra on both sides were opened up and discharged pus; *x*-ray examination also showed extensive necrosis of the alveolus. The antra eventually closed up satisfactorily. During early part of treatment, after extended extraction of teeth, etc., patient's health deteriorated, she lost weight, became very weak, scarcely able to walk, but began gradually to regain her health. Wassermann was negative.

March, 1918, wt. 117, Hb 95 per cent., sleep fairly good; still complains of tiring out readily. Considerable involvement of bone still remained, but it was deemed best to temporize, as she was improving. On my advice, she went to Atlantic City. While there she became very nervous, did not sleep, and on her return to Toronto I examined her on May 1, when her weight was 112 pounds, and she complained of numbness in the whole of the right side of the body, jerking and twitching. Her eyes were bright, and slightly prominent; she had distinct tremor in the fingers; pulse 120; marked thyroid enlargement, mostly the middle lobe. May 11. Feeling better, pulse still 120, very nervous, very marked tremor and thyroid enlargement. Tonsils small; buried; pus readily expressed from crypts. *S. viridans* in cultures. June 18, tonsils removed by Dr. Wishart.

Associated diseases, oral sepsis, tonsillitis, double antral suppuration, rheumatism, sciatica, urticaria, anemia, nervous exhaustion, exophthalmic goiter.

Case III.—Miss A., age 25, nurse in training, not robust, but never suffered any acute illness except recurring attacks of tonsillitis, following last of which she developed rheumatic pains, grating in both knees; ankle joints are still so stiff that she walks with difficulty. Tonsils were removed in Minneapolis some months ago, but no improvement. Thyroid gland is moderately enlarged, uniform in outline, quite firm. Eyes glistening, but not especially prominent. Slight tremor in fingers; general nervousness; pulse 120; *x*-ray examination by Dr. McDonagh showed left upper first molar and right lower first molar to be septic. Oral sepsis, infective arthritis, Graves' disease. On removal of septic teeth, rheumatic condition cleared up, as well as symptoms of Graves' disease.

Some years ago I saw in consultation a patient with slight thyroid enlargement and symptoms of a mild type of Graves' disease, also neuritis. She had extensive crowns and bridge work with marked evidence of infection, but as she had paid a large sum of money for the dental work she refused to have it disturbed, and submitted to thyroidectomy. In the light of recent investigations surely this was not the proper treatment.

Recently I was consulted by a physician, age 42, suffering from severe exophthalmic goiter, marked cardiac dilatation, enlargement of the liver, with jaundice, albuminuria, and casts. He had marked oral sepsis associated with numerous gold crowns. His condition was such as to preclude extensive extraction at the present time, and yet I do not believe he will improve appreciably until the oral trouble is cleared up.

In my series of cases, 257 of oral sepsis, I have had 27 of exophthalmic goiter, in 5 cases alone, in 22 associated with other disease conditions. In one patient there was marked tenderness on pressure over the gland. My own experience fully confirms that of others that oral infection is one of the causes activating the thyroid in exophthalmic

goiter, and, like tonsillitis and other focal infections, should be carefully considered in the treatment of this disease.

In diabetes the evidence is not so conclusive, yet the interrelationship of diseases of the ductless glands is well recognized. This has usually been put down to the action of hormones, but could as readily be explained by infection attacking tissues similar in structure. It is well known in the treatment of diabetes that infection will at times cause return of glycosuria without change in diet.

Oral sepsis has long been recognized as an accompaniment of diabetes, but has generally been considered *a result* of the constitutional condition. I believe experience warrants our considering it as a possible cause of the disease. In my series of cases was one showing marked oral sepsis, goiter, acromegaly, arterial hypertension, hemiplegia, and bulbar symptoms.

In certain skin diseases, as the erythema group, purpura, urticaria, eczema, and, I believe, in some cases of lymphangitis, scleroderma, and Raynaud's disease, oral infection should be borne in mind as a possible cause. In my series there were five cases of Raynaud's disease, four of which were associated with other diseased conditions commonly found accompanying oral sepsis.

Oral infection may be contributory to the development or aggravation of arterial hypertension in some instances. There is no clinical doubt that it may be responsible for nephritis and infections of the urinary tract.

Case IV.—W. I. C., May 22, 1917, railway conductor, age 45. Had always enjoyed good health, and applied to the Imperial Life Insurance in May, 1917, for insurance. Urine was found to contain large amount of albumin, considerable number red blood cells, and large number of puss cells. Was referred to me for examination on June 5, 1917, by Dr. F. J. Farley. Found his teeth to be in horribly septic condition; general physical examination was negative; skin dry, and he looked anemic. Examination of urine showed spec. grav. 1007, moderate amount of pus, distinct trace of albumin; bacteriological examination and inoculation were both negative. Phthalein output showed right kidney 1½ hrs. 10 per cent., left kidney 1½ hrs. 10 per cent. Practically the only treatment carried out was removal of the teeth. After three weeks he called to see me, and reported himself 50 per cent better, and by autumn had entirely recovered, the urine being quite normal.

Apart from gall-bladder infections, involvement of the liver itself, with recurrent attacks of chills, fever, hepatic enlargement, and jaundice, occurs at times, as illustrated by the following case:

Case V.—R. S. N., August 11, 1917. Age 62; judge; best weight 176, present 146. Moderate in all habits, working under severe strain, prostate removed by Dr. S. Hay three years ago; also stones in bladder. The latter has been irritable ever since; recurring attacks of cystitis. Past winter has been having recurring attacks of chills, slight jaundice, loss of appetite and weight, weakness, etc. At the time

of my examination the patient was distinctly jaundiced; much emaciated; lips cyanosed rather than pale, skin dry and parchmentlike; mouth contained many crowns, bridges and fillings, associated with an extreme degree of sepsis. The heart sounds were weak, Blood pressure 95-99 systolic, 75 diastolic. Abdomen was very soft, relaxed, and pendulous; liver markedly enlarged, lower margin palpable to near umbilicus. Never any distinct tenderness over gall-bladder area. Urine contained distinct trace of albumin, also pus and bile. Heart was exceedingly weak, impulse practically imperceptible, and sounds scarcely audible with stethoscope. Cultures from the blood at this period were negative.

On September 1, 1917, teeth were all removed, which was followed immediately by an extreme degree of collapse; patient was pulseless, cyanosed, and for a few days his condition was exceedingly critical. Within a short time, however, he began gradually to improve. While chills occurred, they were less severe. His weight had been reduced to 127 pounds. During the next few months the patient continued to have recurring attacks of chills, fever at times rising to 103°, remaining up perhaps 48 hours, or less, accompanied by slight jaundice; general weakness.

On January 18 he wrote me: "I weigh 135 pounds, living almost normal life so far as eating is concerned."

February 6, 1918, weighed 141 pounds; systolic blood pressure 108, color good, jaundice cleared, skin softer and more elastic; hepatic dullness at costal margin; heart sounds clear and of very good quality; mouth in good condition. He was attending to his official duties, feeling very well.

May 20, 1918, he weighed 148, looked perfectly well, and was following his professional duties; he still had slight cystitis. His liver was normal in size, and there was no jaundice. This patient evidently has suffered from a diffuse cholangitis and myocardial weakness due to oral sepsis; cured by extraction of teeth and general treatment.

Tonsillitis and cervical adenitis are commoner and more obvious results of oral sepsis, which should be borne in mind. The tonsils frequently are small and buried, so that evidences of infection may be readily overlooked on superficial examination. Tonsillectomy should not be done until the oral infection is cleared up.

It has definitely been established that inflammations of the uveal tract are frequently due to oral infection. Billings and others have reported cases with the clinical picture of disseminate sclerosis; also cases of iritis presumably due to this cause.

In addition to cases where there is a definite regional localization, others of a more general character occur in which there is more or less malnutrition, with dryness of the skin and nervous symptoms of the neurasthenic type, such as insomnia, fatigue, palpitation, flatulence, etc., where oral sepsis appears to be an exciting cause or at least to play a part.

In conclusion, I would caution against too hasty and sweeping generalizations, but urge that each suspected case be carefully and critically investigated, to determine if oral infection is responsible for or contributory to the symptoms. In my opinion, teeth should not be sacrificed on the advice of the physician; a competent and experienced dentist is

best qualified to advise as to the applicability of limitations of dental treatment. In many cases the interests of the patient will be best secured by consultation between dentist and physician.

In connection with the preparation of this paper, my thanks are due to Dr. R. W. Mann for bacteriological examinations and Dr. Harold M. Tovell for assistance in the *x*-ray investigations.

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DISCUSSION

Dr. Henry Beates of Philadelphia said that the wife of a Philadelphia surgeon was supposed to have a cerebellar neoplasm. She had remarkably beautiful teeth. However, a skiagram was taken of the mouth and 7 apical abscesses were found. The teeth were removed and a few days later the symptoms entirely disappeared. It was not necessary always to advise extraction when the skiagram showed suppuration, but one should defer to the opinion of a competent, skilful dentist who could tell what could be done in the way of prophylaxis. Some cases of inflamed peridental membrane could be successfully treated. Another physician was told that he had a malignant growth at the angle of the jaw. The mouth was examined and a crown which had been on for ten years appeared suspicious and other roots were the seat of pus. The extraction of this tooth resulted in the disappearance of the supposed parotid carcinoma. Another case was that of a young girl of 19 years, who was in bed for 11 months with polyarthritis and immovable joints. Extraction of a molar with apical abscess was followed by improvement and in a few months she was restored to useful life. Except for slight stiffness of the right knee, she was normal.

Dr. Robert T. Morris of New York said that the objection made constantly by many good dentists was that they did not wish to destroy thousands of dollars worth of good work to follow out theories. Many of the best dentists did expensive, beautiful work, and patients also were unwilling to have the work interfered with. The physician had to contend this point. On the other hand, one might go to extremes in ordering too many teeth pulled out. There were, fortunately dentists of such good experience and judgment that the matter might be left to them. It was extremely important for the doctor to choose such a man, who possessed the proper degree of knowledge and who could be depended upon to exercise the judgment required in the case.

Dr. Beverley Tucker of Richmond, Va., said he was interested in the incidence of Raynaud's disease with oral infection. Focal infection was not confined to the teeth. Tonsils and sinuses were also responsible. In 1914 he had made the statement that pellagra was probably due to some focal infection and that it was not, as generally supposed, a dietetic disease. He had never seen, in the study of 1,000 cases, one pellagrin with good teeth. It was necessary to choose a reliable dentist. Dr. Tucker said that he refused to be responsible for his patients unless they went to a dentist in whom he had entire confidence. Another point was that there was a possible connection between focal lesions and Parkinson's disease. It would seem as if dentistry should become a branch of medicine. In the light of the fact that dentists were endangering many lives by lack of knowledge of medicine, this would be the most desirable solution, and no doubt the coming years and increased knowledge would bring it about.

Dr. W. M. Sprigg, Washington, D. C., said that when the teeth were normal to the eye and yet there was root involvement, the oral surgeon had a distinct procedure to perform. This was amputation of the apex, after careful *x*-ray work. Instead of removing the teeth, the infection could be removed. Importance of teeth, as regards digestive capacity, was very great, and when they could be saved the oral surgeon was the man to do it.

SURGERY IN ITS RELATION TO THE PSYCHOSES AND THE PSYCHONEUROSES

By ROBERT T. MORRIS, F.A.C.S.,
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Horticulturists who have developed a fine variety of plant are sometimes discouraged by the appearance of a blight which undoes the work of many years. Freud is a blight, appearing in the midst of our success with the Virchow method of objective teaching. Virchow taught that every disease depends upon objective factors which may be discovered by an observer sufficiently well equipped. He was the great Liberator, the man who took us away from superstition and from metaphysics in relation to disease. Freud, coming upon the scene as a blight, takes us back into metaphysics and superstition. There is no doubt but Freud has opened the way for new observations and classifications, many of them of value. When a new form of blight strikes the potato crop the phytopathologists have an abundance of material with which to work and to construct new theories. The Freudean conception of mental derangements as being due to repressed desires and conflicting emotions is directly opposed to the surgeon's point of view based upon Virchow's objective teaching.

The surgeon assumes that mental derangement is a symptom, not a diagnostic entity—a symptom like a cough, for instance, which may be produced by many fundamental causes. The delusions and hallucinations of typhoid fever, purperal septicemia, alcoholism, and melancholia, let us say, are not very different in character when considered purely from the standpoint of hallucinations and delusions. The four different causes for the same kind of "cough" are apparently far apart, and yet perhaps not so far after all. We assume that the hallucinations and delusions of typhoid fever are caused by certain enzymes resulting directly or indirectly from bacterial influence. In puerperal insanity we likewise assume that the mental symptoms depend upon enzymes of bacterial origin, directly or indirectly. In alcoholism we make the same assumption, the microbe in this case which furnishes the primary enzyme being saccharomyces. In the case of melancholia the surgeon

again makes the assumption that the hallucinations and delusions are from an enzymic source. Why do we not speak of typhoid fever as an insanity, and of melancholia as an infection? In typhoid fever the symptoms run an acute course marked by liberation of energy in the form of heat in unusual degree, and for that reason we get to look upon typhoid fever as an infection rather than as an insanity. In puerperal insanity we are one step nearer to the case of mental derangement in which heat does not happen to be liberated in unusual degree. A step nearer still when we come to alcoholism. When we have arrived at a consideration of melancholia the comparative slowness of its development and the absence of the feature of liberation of energy in unusual degree of heat has had the effect of turning our thoughts far away from any classification of melancholia and of typhoid fever as being cousins german in the family of microbic diseases. Many of the other insanities belong in this same group from the surgeon's point of view, but in order to concentrate attention upon the main point let us speak for the moment of melancholia alone.

Hippocrates and Galen seem to have given more thought to the enzymic nature of melancholia than do our modern observers. They referred to symptoms as being due to "humors proceeding from the bowel"—the same locality from which the "humors" proceed in typhoid fever. Aretaeus, one of the best observers after Galen, gave a great deal of attention to the question of melancholia as a disease of intestinal origin.

Let us now take up another point, that of the nature of the enzyme producing certain symptoms similar to those produced by typhoid fever, by puerperal sepsis, or by alcoholism. Melancholia may supervene upon sudden mental shock. It may result from a long continued peripheral irritation like that of loose kidney. "Surely this does not mean the same enzyme," some of you are saying. If the sudden shock and the long continued peripheral irritation both have the effect in common of so disturbing the sympathetic and autonomic nervous centers as to result in disturbance of the digestive apparatus, such disturbance may lead to the development of an excess of certain bacteria in the enteron. If we look on the matter in this way we shall gradually be nearing the surgeon's point of view that a focus of infection may enter into an unusual degree of activity as a result of many factors which lessen resistance of the individual toward bacterial invasion. We need not even assume that it is always the same bacterium which gives rise to symptoms like those of melancholia. Various antibodies and various metabolic by-products called out by the presence of bacterial enzymes may be the particular poisons causing the "cough" known as melancholia.

Why should one patient develop symptoms of melancholia when the next ten people exposed to what would appear to be the same disease factors do not have melancholia? Our newer surgery of to-day assumes that one individual is sensitized, allergic, makes anaphylactic response, whatever one may choose to call it, while the other individuals do not happen to make that kind of response. This, it seems to me, is the keynote of the whole subject of the psychoses. Someone will ask about hereditary influence. In certain families there is hereditary tendency toward "rheumatism" of the sort now known to be bacterial in origin. Certain families may be susceptible to the influences which lead toward mental derangement as other families are susceptible to influences leading toward arrested development of some structure. The surgeon of to-day aims at the removal of peripheral irritations and of focal infections on general principles for improving the status of general health of the community. Surgery aimed directly at cure of the psychoses and the psychoneuroses will be a failure because so many factors are involved, but surgery which removes peripheral irritations and focal infections among the insane and among the psychoneurotics will have many spectacular recoveries from the insanities to its credit.

In this brief paper there is no need for my giving detailed description of cases of my own in which there has been recovery from psychoses and neuroses, but these are sufficient in number to lead me to feel that one of the greater new vistas in the whole new field of medicine is about to be opened.

Laboratory facilities which are required at the present time entail so much expense that public benefaction must stand behind the men who are at work in this field.

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DRUG ADDICTION AND ITS TREATMENT

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History records that the aborigines had recourse to drugs for the purpose of making them less amenable to sensations of disturbances or pain to which they were subject by reason of occupation or by reason of the climate in which they sojourned.

The drugs which have been used for that purpose are numerous. We of to-day, however, have to take into consideration only a select

few. There is, to begin with, opium and its derivatives, among which morphine and heroine stand out pre-eminently as the drugs of choice of the addict. Next to these cocaine, hyoscyamus, cannabis, paraldehyde, and to a lesser extent alcohol, have found their place for similar purposes, but it can hardly be said that the last named are narcotics in the true sense of the word, at least not in so far as habit formation is concerned, unless we perhaps except alcohol, which, however, does not come up for discussion. Admitting, to begin with, that drug addiction is a disease, we should as scientific men, consider it from the same aspect from which we consider other diseases. That is, we must divide it into predisposing and exciting causes, into the phenomena or pathology associated with the disease itself, the prevention of that disease, and last, but not least, the cure of the immediate affliction and the after treatment. The predisposing causes leading to drug addiction, no doubt, must be looked for, first in the social condition and conditions of labor which obtain among the civilized people. We all know that as civilization progressed the demands upon man became more and more insistent. Greater energy outlay is demanded daily, and to meet these requirements stimulation, either mental or physical, becomes obvious, nay, becomes almost imperative. Some of us obtain that stimulation by change of work, by vacations, by hobbies which we enjoy and which give us a mental or physical rest or both. Others, less careful perhaps in the choice of their relaxation, have recourse to the handy but injurious drug.

Once in a geat while the members of the medical profession are the cause of the contraction of the drug habit. It is quite often a relatively easy matter to relieve a suffering patient from pain by the administration of a narcotic. While I fully realize that it is the duty of the physician to allay suffering and cure disease, yet I believe we should lay more emphasis on the latter part of the sentence, that of curing disease rather than to allay suffering. It is for this reason that I wish to emphasize the wrong which the physician commits when he has recourse to the administration of a narcotic for the purpose of easing suffering rather than attempting to analyze the cause of the suffering and removing that cause.

Another and perhaps a most important factor in the promulgation of the use of narcotics has come into vogue recently. As long as the sale of narcotics was not surrounded with so many restrictions and as long as the legitimate use of narcotics was made relatively easy and the obtaining of narcotics for legitimate purposes was within the reach of the suffering public on the one side and within the scope of the prescribing practitioner on the other, there was no special inducement for any man or class of men to increase the use of narcotics. But

within recent years, whether necessary or not, a number of laws, intended of course honestly to reduce the abuse of narcotics, have been passed both in the State legislative body and in Congress, and thus the obtaining of drugs has been made relatively, I say relatively, more difficult.

Because of this increasing difficulty those people who think they have to have the narcotic are willing to pay almost any price in order to obtain it. Commercial history has proven that wherever there is a demand there will be the supply and so, in the case of narcotics, the demand being there it was but a short time before the supply was available. Naturally, of course, that supply was there merely because of the profit there was in it, and the more difficult it was made for the general public or even for the physician to use the narcotic or to prescribe it, the more lucrative was it made for those people to handle it; in fact, it became an inducement for them to increase the use of narcotics by illegitimate means in order to increase their profits.

Summarizing, then, the various factors leading to the contraction of the drug habit we have first the inclination or the desire of people to obtain relief either from mental or physical disturbances; secondly, the need of the drug to overcome suffering associated with pathological conditions, and lastly the vicious habit contracted either through environment or by the activity of the nefarious underground channels, whose object it is to increase their clientele and thereby to increase their profit.

The pathology of the drug addict is rather complex. We do know that while at first the use of the drug diminishes sensation and makes them less susceptible to the discomfort incident to whatever it may be, the sequelae are a disturbed metabolism and an ever-increasing desire for the drug. The fact that there are actually no demonstrable histopathological lesions does not alter the conditions in any way; it remains a disease associated with certain phenomena and certain symptom-complexes. The principal thing for our consideration, however, is the treatment of the disease itself. This must be divided into prophylactic, immediate, and after treatment.

The prophylactic treatment of the drug addict, or rather against the use of the drug, will resolve itself in making the drug inaccessible to the public excepting where it is needed and advised by a legitimate practitioner for legitimate purposes. The present laws do not accomplish it for various reasons.

To begin with, each State has a different narcotic law. While it is true that we have a Federal law, the Harrison antinarcotic law, it is equally true that it is not a prohibitive law, but rather a revenue law or a registration law. Any physician, and legitimately so, may obtain

the drug and use it. Any pharmacist or manufacturer may obtain the drug. But it does not in any way prevent the dissemination of the drug throughout the United States, even though its production and its distribution are fairly well regulated, for the reason that it does not prohibit the importation of the drug into the United States from adjoining countries. So, for instance, Canada on the one side, Mexico on the other, Cuba, and even far-distant countries, are enabled to ship the drug into this country.

It is true that the legitimate importation would necessitate the registration of this drug when imported. But because of the great inducement offered to underground dealers through financial returns which they can obtain therefrom, it has opened up a considerable traffic in these narcotics, and I might say that at least half of the drugs that find their way into this country are smuggled in. Therefore the only way in which such importation or smuggling into this country can be stopped is by international agreement with other countries, requiring them to exercise as careful and thorough a supervision over the manufacture and export of the drug into foreign countries as we do in this country. Thus every bit of narcotic produced anywhere in the civilized world should be placed under government supervision and every grain manufactured or exported would have to be registered and accounted for. This would be a step in the right direction and is, as I said before, a matter of international agreement.

Furthermore, the general practitioner should exercise considerably more care in the prescribing of narcotics. This would do away with some, I will admit a small, part of the abuse of the drug, but one which is however worthy of consideration. And finally, when a physician finds that he has to use the drug, it is perhaps as well that the patient receive it in such a manner that he will not know that a drug of this type is being administered. Therefore, I advocate the discontinuance of the hypodermic syringe whenever possible and the administration of the drug either by the mouth or in the shape of suppositories by the rectum, or through other body surfaces. Now as to the treatment of the drug addict himself, this is quite a chapter and well worthy of consideration.

There are relatively few, if any, of the drugs now in use, the withdrawal of which will not cause untold suffering. Theoretically, we could use the physiological antidote, as for instance atropine, to antagonize the effects of the drug. But we must bear in mind that we are not dealing with the effects of the drug physiologically, but with the pathological conditions induced by the abuse of that drug. Therefore, eliminating of course those conditions in which the need of the drug is prompted by other pathological conditions and suffering incident thereto and considering only the conditions emanating from the abuse of the

drug itself, we must concentrate on two things: first, to teach the patient that he can get along without the drug; secondly, we must combat the symptoms which arise with or as a result of the withdrawal of the drug: First of all, as in all other conditions, resort must be had to the elimination of the cause leading to the use of the drug. Secondly, the physical condition of the patient is of great importance. Therefore, we should give the patient a reasonable amount of cathartics and at the same time build up his physical resistance by training, by exercise, by proper employment and the right food, so as to enable him to stand the suffering with greater composure and eventually to help himself to overcome the disease.

In this, of course, we must consider that we are dealing with two kinds of patients: those who are anxious to get rid of the affliction and those who only pretend. With the latter I feel that we can do nothing. But given a patient who is honestly anxious to shake off this nefarious addiction, then we must stand back of him and in every way encourage him to do without the drug, by gradual reduction and by building up his resistance. In order to overcome some of the symptoms a purely symptomatic treatment will, of course, have to be resorted to.

Assuming, then, that we are dealing with a case of frank drug addiction, willing to be cured, we must bear in mind that the first thing to do is to put the patient in a position where he would be unable to obtain the drug except through our own channel or by our own administration. We know that with the best intentions in the world the ability to obtain the drug might lead one into the temptation to get more than the physician treating the case deems necessary. So that we must at once dismiss from our consideration the ambulant treatment of the drug addict. That has been proven repeatedly to be a failure and, therefore, if we are honestly endeavoring to cure the patient we must put him either under the supervision of intelligent and trained nurses at home or in an institution where we can thoroughly and absolutely rely upon our orders being carried out. The first thing to do with a case of that kind, after securing proper nursing, would be elimination. Such elimination should be carried out intelligently and should not tend to weaken the patient's condition. Excessive catharsis is not to be countenanced for a moment.

Among the drugs offering themselves for our consideration magnesium sulphate and pilocarpine are the remedies of choice. Magnesium sulphate, as we know, will effect the desired result either promptly or delayed, according to the dilution in which it is given. If we wish to obtain a delayed effect we must give it in concentrated solution, a 25 per cent. solution without the addition of more water. If we wish to obtain immediate result, as we often do in these cases, we must give it

in a dilution not to exceed a concentration of 5 per cent. Plenty of water even beyond that may be given. Pilocarpine may be administered in the form of tablets in doses of 1/10 to 1/5 a grain two or three times a day. The surroundings should be pleasant. The nurse in charge should be selected with a view of being in harmony with the patient, and all outside disturbances should be excluded, even to the point of forbidding the visits of friends and relatives. The drug itself, whatever it may be, whether it be morphine or heroine, should then come up next for consideration. As an initial step a reduction of the dose to 75 per cent. of the previous dose should be resorted to. This can be continued for twenty-four hours, when a further reduction bringing it down to one-half the previous dose should be applied and within a few days the patient ought to be down to a dose of 5 per cent. or even 2 per cent. of the original dose. When we have reached the minimum which he will stand without any marked discomfort we may continue that for a week or ten days and then try to have him get along without the drug altogether. At all times our personal contact with the patient should be one of cheer and one of physical, moral, and mental support. The food should be nutritious but not rich. The diet should be measured with a view of giving him physical support rather than with a view of over-indulging in his desires. At the same time excessive deprivation of food should not be encouraged.

Should mental symptoms make themselves felt then we will have to follow the usual rules obtaining in therapeutics; that is, to stimulate when depressed and to depress when overstimulated. In our choice of the stimulant it is well not to indulge or introduce a habit which will take the place of the previous one and which might be just as injurious to the patient. Small amounts of strychnine will answer the purpose admirably. Alcohol should not be given under any circumstances. As a depressant, or rather as a sedative, bromides or hyoscyamus may be used, but in no greater doses than is absolutely necessary to bring about the desired result. Thus the elimination, the symptomatic treatment, the food, the reduction of the drug, and the surroundings, or rather the cheerful surroundings, are the important matters in the treatment of the addict. But at all times the psychic influence on the patient should be borne in mind. We must be an instructor, a mental instructor, a psychical instructor as well as a physician. We must at all times emphasize the fact and bring it home to the patient that he can get along without the drug, and we must also bring it home to him that he is doing most of the work and can do all of the work necessary to break himself of the addiction. A word to his friends and family, who are familiar with his condition, is also essential. No reference should be made by them to his condition unless it be one of cheer and comfort

and encouragement. When we have reached a point where the patient can get along without the drug for some time we must outline a régime of physical exercises, occupation, and pleasure together with the proper diet which will keep him in good physical and mental trim. With the wealthier class this is relatively easily accomplished. But with the mass of the poorer people we must provide that the conditions which primarily drove them to the use of the drug are not repeated again so that they may perchance again have recourse to the drug. In other words, we must provide the after-treatment. For this purpose the State or Federal authorities should take care of the after-treatment of the addict just as they are now taking care of the insane. In fact, if the so-called addict is provided for we will have less need for the insane asylums. An organization similar to the Big Brotherhood is the thing that I have in mind—people who will look after the cured addict, who will more or less regulate his amusements, his entertainments and employment. It is the duty of the medical profession to recognize the condition of this evil and to advocate proper measures, both for the prevention of the treatment and the after-care of the drug addict.

Conclusion.—I have endeavored to draw a bold outline of the causes, treatment, and after-treatment of drug addiction. I wish to emphasize that no definite rule or set of rules can be laid down. Each case must be considered as a distinct entity, offering problems which the physician must solve individually and intelligently. No "cure" exists for drug addiction. But the drug addict can be cured if the physician takes the time and trouble and possesses the intelligence and the patience to carry out some of the principles laid down in this discussion.

DISCUSSION ON PAPERS BY DRS. MORRIS AND DINER

Dr. E. Zueblin of Cincinatti said that he would congratulate Drs. Morris and Diner on their presentations. In dealing with psychoses and psychoneuroses, it was unfortunate that the psychologist seemed to have gone his own way in disregard of the practical experiences of his medical colleague. Notwithstanding the resistance of the medical practitioner to things pertaining to the so frequently misunderstood domain of psychoanalysis both parties meeting on common ground could learn from each other. Freud in his studies had gone far to shock both patients and physicians by his revelations which contained a grain of truth not to be disregarded entirely. All possibilities ought to be considered in these border line cases, whether the manifestations were due to a functional or organic disturbance of the nervous system. At the time of Hippocrates hypochrondria or melancholia was connected with intestinal or hepatic disorders; in our epoch, when we were better acquainted with the functional relation of the sympathetic nervous to the central nervous system, such a conception would meet less criticism. Dr Diner had laid stress on re-education, which, in the speaker's opinion, should not be restricted to the drug habit alone, but ought to be considered in most of the cases treated medically. In contracting disease the patient somehow had erred against the rules of proper hygiene, against

proper nutrition, and in paying the penalty for his error with morbid symptoms the patient must learn how to avoid the recurrence of similar manifestations.

Dr. Henry Beates of Philadelphia said that the point was well taken that the asylums would have fewer inmates if attention were accorded to certain conditions, and among them hereditary unstable and hypersensitive nervous systems. So to train mentation that a well established equilibrium was formed between the intellectual, emotional, and volitional was the principle involved, and so training drug habitués through a specially developed pedagogic art was the task to be perfected. As to hereditary psychic hyperesthesia, infections and toxemias of chemical and biochemical origin played a potent role in provoking psychoses. Two sisters, whose grandfather was noted for furious temper and who died of cerebro softening, and whose father was in earlier life an alcoholic, both developed a psychosis—one from decayed teeth and peridental abscess, the other from retained secundines after parturition. The surgical correction of the mouth and of the uterus respectively resulted in complete recovery after a few months. The dental case remained well for six years when abscess of a molar resulted in a return of the same condition. The patient at once consulted the speaker and in less than an hour the tooth was extracted. That very night, Dr. Beates said, the mind became normal.

MODERN THERAPEUTICS IN THE NEW YORK STATE HOSPITALS FOR THE INSANE

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In my review of the newer methods employed in the treatment of the insane in the Hospitals of the State of New York I make no claim for originality, but on the contrary wish it understood at the outset that this paper is merely a collation of facts, a regrouping of statistical matter, and a different presentation of what has already been gathered, much of which has been offered to the profession by others from time to time.

It is indeed a far cry from the legislative enactment of 1788 which provided that justices of the peace might chain those "furiously mad" or "so far disordered in their senses" as to be dangerous if permitted to go abroad, to the present rule of the New York State Hospital Commission which forbids the use of the strait jacket and other methods of restraint; from the day of narcotics, sedatives, and hypnotics to that of the continuous bath, exercise, hygiene, and suitable employment; from the day of the poorhouse and the jail with the county system of maintenance to State care and maintenance under a central authority; from one State institution with a capacity of but two hundred patients in 1831 to thirteen civil and two criminal hospitals which in 1917 had a population of nearly thirty-eight thousand; from an annual expenditure of not

more than $25,000 to the use of nearly $10,000,000 for care and maintenance alone.

In order to appreciate what the newer methods are it will be well to epitomize briefly what the former practice was.

Originally any insane person who was so unfortunate as to be committed was placed under arrest and pending his commitment detained in a jail or locked up in company with criminals and prostitutes, and there held with no medical supervision and later sent to the poorhouse or county asylum, if such there happened to be, where practically the only treatment he received was harshness, restraint, and the administration of narcotic drugs.

The first comprehensive step looking toward scientific care was in 1890 when an act of the Legislature provided for State care, but it was not until 1893 that all the insane were removed to State institutions, there being then 2,200 patients in the various poorhouses in the State.

To-day the law forbids the detention of the insane in jails and prisons (unless they be criminals as well) and provides that the health officer shall be responsible for the welfare of the individual pending commitment, making him responsible not only for the patients' detention but for his safety and comfort as well, and allows him to give the patient the care of a physician and a nurse. And it further provides that women patients shall not be transferred by men attendants unless such attendant be a near relative.

In a number of the larger cities of the State, notably Albany, New York, Brooklyn, and Syracuse, there are large psychopathic hospitals or wards devoted exclusively to the use of the mentally sick where they may be under observation for a time pending commitment or discharge, these hospitals or wards being in charge of trained alienists and nurses who devote themselves solely to mental cases.

Whereas under the old system the idea was custodial and the treatment was general and repressive, consisting mainly in harshness and restraint, to-day it is directly the opposite, being individual, special, hygienic, occupational, uplifting, and mentally and morally stimulating, and conducted strictly on the hospital plan.

When a person is committed to one of our State hospitals he is taken to the institution in the care of one or more specially trained nurses and frequently a physician as well, he is there carefully examined and a detailed family, personal, and medical history is taken, and he is then placed in what is known as the reception ward where he is bathed, given suitable clothes, and kept under careful observation for some little time in order that his type of psychosis, his individual idiosyncracies, and his temperament may be determined. After a period of observation he is brought before the medical superintendent and the hospital staff where

he is examined, his case is presented to the staff by the physician in charge of him and after discussion by the staff, the medical superintendent determines to what ward he shall be sent and, in general, the treatment he shall receive.

Violent or excited cases which formerly were kept in restraint by means of the so-called straitjacket and the use of narcotics and similar drugs (now fortunately absolutely abandoned), yield promptly to hydrotherapy in the form of hot and cold packs, continuous warm baths, showers, spray, and douches. To this is added massage and in many cases the use of electricity.

Instead of prison surroundings we have books, pictures, flowers, music, amusement, and employment; there are drills, dancing, calisthenics, games, and theatricals, each and all under the careful supervision of physicians, trained attendants, and nurses. Most of the hospitals have large farms connected with them on which the patients may work, raising not only food but flowers as well. The kind and type of occupation best suited to the individual and his needs is selected for him after observation, such as basket making, the weaving of rugs, making of shoes and brushes, etc. There are brass workers, masons, engineers, carpenters, painters, and plumbers. Some knit, some make artificial flowers, others work in the laundry or the kitchen; they may be found pressing clothes, digging ditches, cutting hedges, setting type, printing books, roasting coffee, or doing clerical work.

One of our large hospitals roasts the coffee for all of the State hospitals and maintains a large printing establishment which does much of the printing for them all. While none of this is compulsory and all is voluntary, about fifty per cent. of the hospital population engage in some useful occupation. How much can and may be done is evidenced by the fact that in 1914 it was reported that the value of the combined manufactured and farm products that year amounted to $715,714.85. But however desirable this occupational treatment may be from an economic standpoint, that is negligible as compared to its therapeutic value, for not only is the physical well-being of the patient greatly improved but his mental viewpoint is markedly changed for the better, in fact so prodigious is the improvement as sometimes to seem to be miraculous.

Patients are provided with games, such as cards, checkers, chess, dominoes, etc.; baseball is played, and contests of skill are held, while the reading of suitable books, magazines, and illustrated papers is encouraged. Religious services are regularly held at all the State hospitals, there being separate services for various sects and denominations. Each hospital has several regular visiting days on which the friends and relatives are urged and encouraged to come and see the patients, over 100,000

visits being made each year at Manhattan State Hospital alone. These visits of friends serve a twofold purpose, for they are found to have a distinctly beneficial effect upon the patients' mental condition and at the same time evidence to the relatives the superiority of hospital care over that which they could give in the home.

The dietary of the hospitals is a matter of special care and study and no effort is spared to obtain the best food the market affords, to prepare it in its most palatable and nutritious forms, and to serve it in well lighted, clean, airy dining rooms with clean linen and attractive table settings.

Most of the hospitals have cottages to which the more nearly recovered patients are assigned where they are watched over by trained attendants and physicians and where they approximate as nearly as possible to domestic and home surroundings. Probably, however, no one thing has done more to help us in our treatment of the insane than individualization—and here I can do no better than quote from a paper of the late Dr. Mabon: "Although mental disorders are diseases in which many of the principles are the same as in other diseases, we are dealing in them with more complicated symptoms and *more subtle causes.* More time is required, therefore, to study the individual patient than is often the case in other diseases. Another point is important in this connection. It used to be thought that it was possible to treat mental disorders in a wholesale fashion, but just as little as this is possible with any other disease, so it is here. To be sure, it was under this conception that the transformation of the asylum into the hospital began, and that much of the present spirit of more humane management of the patients was created, but the development went, and has still farther to go, in the direction of the individual treatment with special indications based upon the facts of each case.

"The very nature of some of the diseases with which the hospitals deal is responsible for the fact that many patients, when they come to the hospitals are chronic and a re-establishment to health is impossible, but even these offer many medical problems. Take, for example, the cases of paresis, one out of every four men admitted to the Manhattan State Hospital is suffering from this disease. Although the treatment of paresis is at present carefully studied with a view to a possible radical cure, these studies have not gone far enough to allow us to assume that such attempts will be successful; therefore, up to the present time the disease has been looked upon as incurable and as leading to death in a few years. It is obvious that these cases of paresis are physically as sick as any other cases with severe bodily diseases; therefore, they need constant, careful medical attention and the most skillful nursing, and it is just as absurd to think that they can be treated in a wholesale

fashion as it is absurd to think that patients with, let us say, cancer, can thus be dealt with. Mere custodial care is out of the question here; and even if the physician is playing a losing game in his grappling with the disease, the present-day spirit of humanity, an important asset of our civilization, will not be abandoned on that account, but everything that is necessary from a medical point of view must be done, and is done."

Senile dementia, too, is a chronic type which can be made comparatively comfortable and happy by sympathetic care and reasonable indulgence by the intelligent nurse; other types with some chronic mental change but not markedly ill physically, present such a change in their attitude toward life with their false ideas and hallucinations that they must be carefully studied by the physician as individuals to preserve in so far as possible whatever of mentality that is left. Other types present possibility for much improvement and some for cure and each one of these is carefully studied and considered by itself and its individual needs supplied wherever possible. The tuberculous patients are isolated and given the care and attention as to air, food, and rest which is considered appropriate in this disease, specialists in their lines look after the eyes, ears, noses, throats, and teeth of the patients, and skilled surgeons correct deformities and operate as needed.

As it is obvious that in order for the physician to visualize a case properly, and to treat it adequately when he has determined its needs, he must be not only experienced and apt but specially trained, so for this purpose the State has established and maintains the Psychiatric Institute, a school to which the various hospital physicians are urged to go for the purpose of studying the underlying causes of mental disorders. At this institute also there is research work done relating to mental disease, the results of which are available to the profession at large as well as the State hospital men.

Valuable as is the training of the physician, fully as valuable is the training of the nurse and each of the State hospitals has connected with it a training school for nurses where all endeavors are made to give special instruction in the care of the mentally sick as well as in general nursing and from it are graduated a distinct type of nurse, one not only competent to care for those physically ill but especially proficient in the care of the mental incompetent.

As the patient improves, more and more liberty is granted him, and when the time seems ripe he is paroled to the custody of friends for a period of six months; his case is still carried on the hospital records and he reports at the hospital at stated intervals so that he may be advised as to treatment.

At the end of six months he may, in the discretion of the superintendent, come back to the hospital, or his parole may be extended another six months, or he may be discharged. When he has no friends the patient is looked after, helped, and advised by the State Charities Aid Association, or by the Department of After Care of the State Hospitals. Other patients remain at the hospital indefinitely but are allowed to come out and go to nearby places with great freedom. Where recovery has taken place sufficiently to warrant it the State goes so far as to seek out the friends and relatives of the patient, even though they be in other States or in distant countries, and when the State is satisfied that the patient will be wisely cared for sends him properly attended and clothed to his proper environment, and when the same is needed gives him a small sum of money for his immediate needs.

Besides all this the State maintains clinics at the various institutions where patients may come for voluntary treatment and advice and sends out physicians who give free lectures throughout the State on mental hygiene. There is also a Medical Inspector who, under direct authority of the State Hospital Commission, visits all the State and private institutions, sees and examines all patients, hears their complaints, and reports his finding to the Commission. He also investigates for the Commission all accidents, irregularities and the complaints of friends whenever such occur.

In the preparation of this paper I am much indebted to papers written by Dr. James V. May, formerly chairman of the New York State Hospital Commission, now Superintendent of the Worcester (Mass.) State Asylum, the late Dr. William Mabon, formerly Medical Superintendent of the Manhattan State Hospital, Dr. Maurice C. Ashley, Medical Superintendent of the Middletown Homeopathic State Hospital, and Dr. Walter G. Ryon, Medical Superintendent of the Hudson River State Hospital.

Room 703, Hall of Records.

A UNIQUE CASE OF RHEUMATISM AND ITS MANAGEMENT

By WILLIAM HENRY PORTER, M.D.,
New York.

To meet with an entirely unique condition in these days of voluminous medical reports is an experience that comes to but few practitioners in the course of a lifetime; and to search vainly through a library of medical writings and finally to find one solitary description of a similar case in an old volume published away back in 1855, merely adds to the unique interest of this extraordinary case. It is almost with a feeling

of joy that one reaches back through the years and clasps hands in spirit with an observer so shrewd, so canny in his observations, that almost we might have been discussing and describing the case which I shall now present.

It was on the 7th of January 1918, that I was called in consultation by Dr. Francis De Revere of Stapleton, Staten Island, to see a young woman of 23. On the evening of the 5th of January, Dr. De Revere had attended this young woman in her confinement. There was nothing unusual about the parturition except that the labor pains were unusually severe. The placenta was persistently retained, and after all the usual means had failed to cause the uterus to expel, the after-birth had to be forcibly removed. Every antiseptic precaution was observed in connection with the mechanical removal of the placenta. Examination of the placenta showed that it had been perfectly and completely extracted. After the expulsion of the child and up to the time of the final removal of the placenta, the flow of blood was unusually abundant. It was not sufficiently profuse, however, to produce extreme exsanguination, but was considerably more so than occurs with a normal labor. On the day following the delivery the patient was practically normal, although rather more blanched than is usually the case the day after confinement.

About midnight of January 6th, or a little more than twenty-four hours after parturition, the patient awoke from sleep. She was very restless and irritable, but had no chill. The temperature rose to 103.5° F. and the pulse to 120. About this time she complained of severe pain low down in the left hypogastric and deep pelvic regions, which rapidly increased in intensity. When seen the next day, the patient was suffering very severely. The slight pressure and light percussion of physical examination of the left hypogastrium and pelvic regions caused exquisite pain, which extended nearly up to the line of division between the hypogastric and umbilical regions. The point of greatest pain was just about the middle of Poupart's ligament and to the left of the enlarged uterine body. These symptoms increased for about three days, during which time the tumefaction in this region could be distinctly seen and felt. It was dull upon percussion. Vaginal examination revealed also a tumefaction of the vulva and vagina, and a large neoplasm of a rather dense character in the left pelvic region. This crowded the uterine end of the vagina and the uterus to the right. There was also a most distressing hemorrhoidal condition and an intense amount of congestion in the entire pelvis and rectal regions. On the third day the pathological process in the left hypogastric and pelvic region reached its height. The pain became less intense. Careful examination failed to elicit any evidence of liquefaction or the formation of pus in connection with the tumefaction.

Dr. De Revere naturally suspected infection and that we had a septic condition to combat. The lochial discharge, however, was perfectly normal as to both appearance and odor. The temperature between these three days ranged between 102.5° and 103.5°. These symptoms without chill and coupled with the fact that the patient did not have a septic appearance convinced me that we had an entirely different pathology to contend with.

On the evening of January 9, four days after the baby was born, and while still at the very height of the tumefactive development, the patient was removed to St. Vincent's Hospital, a distance of two miles from where she lived. She suffered excruciating pain during the trip. At the time of her admission to the hospital, the temperature was 102.2° F., pulse 104, respiration 26. By 12 o'clock noon the following day the temperature had risen to 103° F., pulse to 110, respiration 26. The pulse and respirations, however, remained practically unchanged. Vaginal examination dis-

closed a semisolid mass on the left side which had forced the upper portion of the vaginal wall and the uterus to the right. The vulva, vagina, and rectum were somewhat less swollen.

On January 11 pain and swelling appeared in the right hypogastric and pelvic regions. It was more intense than on the left side, and the protrusion of the abdominal wall was greater on the right side than on the left. The temperature rose to 103° F., the pulse to 105; respirations, 28. The abdomen was tender up to the umbilical region. The right hypogastrium was very sensitive to the touch; the pain greatly increased upon even the lightest percussion. All over the protrusion the percussion note was dull, almost flat. The enlarged uterine body could de distinctly felt as a firm pear-shaped mass. Instead of the uterus lying directly in the median line, it was diflected to the right, especially the fundus. This was due to the pathological neoplasm which formed first in the left side, pushing the uterine body to the right and upward. When the same condition formed in the right pelvic region, there was less room for the growth, hence it rose out of the pelvic cavity and protruded to a greater extent in the right hypogastric region.

At this point, in connection with these pelvic developments, it may be interesting to note that the patient had had more or less rheumatism all her life. For six weeks prior to her confinement she had suffered severely with what had been diagnosticated as rheumatism of the right hip-joint. This condition was so acute that at times she was almost unable to get about. These facts, in connection with the clinical picture as just outlined, led me to make a diagnosis of rheumatism, instead of tacitly agreeing with Dr. De Revere, who argued in favor of its septic origin. This conclusion was emphasized in my mind by the fact that the masses were of a persistently doughy nature and showed no tendency to liquefy.

Up to this point the patient had received the ordinary treatment accorded a case of sepsis. Inasmuch as there had never been any offensive lochia, it had not been thought necessary to use antiseptic douches. The patient had received one or two hypodermics of morphine; hot stupes over the abdomen and quinine in full doses were administered for the first three or four days of the illness, with but slight improvement.

After entering the hospital she became extremely restless; therefore an ice-bag was placed upon the head and another over the right hypogastric region. The head of the bed was raised about two feet. This treatment was continued for about eleven days. The tumefaction in the left pelvic fossa gradually subsided during this period, and that on the right began to subside.

On the seventh day after admission to the hospital, the temperature dropped to normal, and remained nearly at this point until about the 11th day when it suddenly shot up to 104 deg. F. There was no increase in the pathological process in connection with this rise in temperature, neither was there any chill nor any increase in pain. Upon inquiry, it was discovered that the bowels had not moved for two days. Free calomel purgation resulted in the lowering of the temperature within the next twelve hours to 99.4 deg. F. Within the next two or three days the temperature again rose to 103 deg., but once more fell after purgation, proving conclusively that this temperature increase was due to absorption from the intestinal canal rather than from any septic condition within the pelvis.

Because of the rise in temperature and the slow resolution, and under the belief that the condition was of rheumatic origin, we decided to administer full antirheumatic treatment, using first what has in my experience proved to be the very best antirheumatic measures. This consists in a freshly prepared solution of salicylate

of sodium with iodides and wintergreen—a modification of Professor Alonzo Clarke's once famous "salicylate mixture."

R. Sodium salicylate .....dr. iii.
Sodium bicarbonate .....dr. ii.
Potassium iodide .....dr. ii.
Elixir gaultheria .....oz. i.
Glycerin .....dr. ii.
Water q.s. ad. .....oz. iv.
M.Sig. dr. ii every 2 hours, pushed until free diuresis occurs.

My theory of the action of the salicylates is that they arrest putrefactive fermentation in the alimentary canal. This prevents absorption of toxic matter, which is, in a measure, responsible for some of the rheumatic conditions. The profuse stimulation of the secretory functions undoubtedly carries the causative toxins out of the body, first because of the waste material flushed out through the sudoriferous glands; second, by the inhibited development of fresh battalions of germs in the alimentary canal; and third, because of the dilating influence these remedies exert upon the entire vascular system, thus drawing the blood away from the pathological zones and relieving pressure upon the nerve endings in the congested zones.

The clinical reason for my conviction is the fact that there is not adequate relief from the rheumatic symptoms until the full physiological action of the remedy is produced, but almost instantaneously following this action the case takes a pronounced turn for the better.

The unfortunate feature in connection with this most efficient therapy lies in the fact that it tends to produce an intense congestion of the stomach, which in turn causes distressing nausea and even vomiting. So pronounced is this effect that the remedy must be temporarily suspended. To obviate all loss of antirheumatic action, we utilize the iodides, oil of gautheria, and acidum acetyl-salicylicum purificatum, all of which have a similar action, and thus prevent the individual from relapsing into the same rheumatic condition while the salicylic acid mixture is temporarily suspended.

During this time the patient received a well-regulated mixed diet consisting of the following regimen:

For Breakfast.—Two eggs, eight ounces of milk, two ounces of wheat bread and butter.

For the Mid-day Meal.—From one-quarter to one-half pound of beefsteak, eight ounces of milk, three ounces of wheat bread and butter.

For the Night Meal.—From one-quarter to one-half pound of beefsteak, eight ounces of milk, two ounces of bread and butter.

At Bed Time.—Eight ounces of milk.

Beefsteak is taken as the working standard among the meats, as it is the most easily digested of all the food stuffs. Under the heading of meat is included lamb, mutton, occasionally veal; all kinds of fish, including the shell forms, such as oysters, clams, lobsters, crabs; poultry and game of all kinds.

The meats to be broiled, boiled or baked.

The fish to be boiled or baked.

The oysters and clams to be eaten raw or stewed. The lobsters plain boiled.

A little crisp bacon may be taken from time to time, also ham and corned beef, *without cabbage.*

Eggs may be taken boiled, poached or scrambled.

The milk is best taken warm or with a little limewater added.

Wheat bread is taken as the standard because it is the most easily and perfectly digested. It should be at least twenty-four hours old or toasted; rye, graham, zwieback, or the health food breads may at times be substituted.

Weak coffee, without milk or sugar, or with a dash of milk, may be taken freely as a beverage. Coffee taken clear aids digestion, but with milk and sugar often disturbs digestion.

Additions to Enlarge the Above Diet.—In the line of vegetables: string beans, green peas, lima beans, spinach, lettuce, asparagus, and cauliflower. These are chosen because they are the least likely to excite intestinal fermentation of an abnormal character. They should be well cooked, and only one vegetable at a meal. When a vegetable is taken with the meal there must be a reduction in the quantity of meat or milk as given in the above table. To the above may be added boiled rice, macaroni, and occasionally boiled beets, carrots, turnips, and squash.

Food Stuffs to be Avoided.—All fruits, either cooked or raw; all cereals and breakfast foods, nuts, sweets, and pastry of all kinds, potatoes in all forms, onions, tomatoes, turnips, parsnips, carrots, celery, radishes, cabbage, egg- and oyster-plant, corn, etc.; pork in all forms, except as before stated. Rich gravies, and all forms of soup are excluded. The latter, first, because they tend to destroy the keen appetite which makes possible the eating of plain and substantial food; second, because they destroy the appetite and stimulate a strong desire for the entremets and highly seasoned foods; and, third, because the mixed, cream and rich stock soups tend to excite undue and putrefactive fermentation in the intestine. Rich gravies, because they disturb digestion.

Potatoes, that are so commonly used, are excluded for three reasons: first, because they have a high percentage of starch and a low percentage of protein; second, because they are so apt to be taken three times daily, and are so often eaten fried; third and chiefly, because of the ease with which the starch contained in the potato is digested and assimilated within the system. In consequence of this rapid utilization of the potato starch, which yields to the animal economy only heat, the oxygenating capacity of the system is exceeded, and there is not a sufficient amount of oxygen left within the body to oxidize and assimilate perfectly the protein constituents of the food that must be accomplished if a perfect state of health is to be maintained. In the repair of the disease conditions it is still more necessary that the proteins shall be perfectly oxidized and assimilated, hence the absolute necessity to exclude the potatoes and food products enumerated.

Fruits are excluded, first, because they are usually picked before they are fully ripe; second, because they are in a state of partial putrefaction, and are often covered with bacterial life when eaten, and often taken in excessive quantities. Having reached the alimentary canal in this state, they excite undue and putrefactive fermentation of protein constituents contained within the intestinal canal and thus prevent the perfect digestion and assimilation of the proteid elements of the food. When these rules are followed a good variety in the dietary can be secured, and a high grade of nutrition established and maintained.

Improvement was manifested within forty-eight hours, and progressed steadily until the pelvic neoplasm had entirely disappeared. With the absorption of the neoplasm in the right hypogastric region a marked varicocele of the right pampiniform plexus was distinctly felt, consisting of a bunch of veins which felt like a bunch of fishing worms; this in turn also disappeared.

With the complete subsidence of the pathological process in the pelvic region, well-defined rheumatic symptoms developed in the left ankle, but these also finally disappeared under the continued antirheumatic treatment.

During the five weeks the patient was under treatment, she lost almost 75 pounds, and she became very anemic and dibilitated. With the subsidence of her rheumatic attack—for that was exactly what it was—she convalesced and gained steadily, and at the end of four months had recovered the greater part of her lost weight. She is now in a fair degree of health, although still taking a stiff iron tonic and occasionally a little antirheumatic treatment.

The universal interest of this unique case lies in its rarity and in the fact that no similar condition has been recognized, except as found described by Dr. P. Cazeaux, a noted French accoucheur, in his "Midwifery." So far as I have been able to ascertain, there is not another case of this kind in medical annals. It is therefore with considerable gratification that I present the details to this society.

Especial emphasis is given to the fact that red meats are never excluded from the dietary in the management of my rheumatic cases. On the contrary, my patients are encouraged to use them. Among the meats representing the animal class of food, the red meats are the most easily digested and assimilated, provided sufficient oxygen is supplied. If too much starchy food is used it often exhausts the oxygen supply before the protein can be perfectly oxidized. Wheat bread, on the other hand, holds the first place among the vegetable class so far as digestibility and assimilation are concerned.

In my opinion, a correct diet is as essential as suitable medication. As a rule, an absolutely restricted diet is not required, but an ideal mixed diet, as just outlined, is always necessary.

46 West 83rd Street.

A CLINICAL STUDY OF THE VARIABLE THERAPEUTIC POTENCIES OF THE GALENICALS, AND THEIR INHERENT UNRELIABILITY

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The title of this brief contribution seemingly justifies the opinion that the writer belongs to that group of discontents classified as hypercritical if indeed not iconoclastic, and yet, when conditions governing Materia Medica, in so far as the galenicals are concerned, are seriously contemplated, it is believed that the briefly outlined imperfections and shortcomings will be recognized as facts that cannot be denied.

If this be true it may activate the inauguration of a widespread movement for the correction of defects that continue to impair the efficiency of the galenical armamentarium, and ultimately result in securing for the clinician medicaments known to possess a uniform standard of physiological potency and therefore means to an end upon which reliance can confidently be placed.

During the past several years, and at the present, consultations in the field of circulatory, renal, metabolic, and nutritional disorders force recognition of the fact that too commonly galenicals are prescribed, properly named, but of unknown potency or value, and failure to obtain logically anticipated results is almost the rule, notwithstanding their administration in the usual but conventionally adopted doses.

These experiences recalled to mind a study of the galenicals, conducted many years ago which consisted in subjecting oneself to a severe or thorough physiological experimentation with several specimens or groups of tinctures; thus five specimens of tincture of aconite were obtained from five different but reputable pharmacists, and so with tincture of belladonna, tincture of nux vomica, tincture of strophanthus, and tincture of digitalis. The infusion of digitalis was also investigated. This study was followed with a similar investigation with the chief active principles of these drugs respectively.

Emphasis is made of the fact that in Nature, the crude drug possesses active principles in vastly varying percentage proportions, and hence it must follow that the galenicals prepared therefrom must be characterized by the same variations of therapeutic power with the qualifying difference, however, that these several principles themselves differ in solubility in the menstruum employed in manufacture.

Not infrequently they are also associated with other active principles in such proportions as seriously to interfere with the administration of a sufficient quantity of galenical to obtain that principal effect for which it is desired.

The testing of physiological activity was begun at 8 p. m. The conventionally adopted dose, for obvious reasons, was repeated at 40-minute intervals, and it was no little surprise to discover that as physiological effects failed to be secured and the doses therefore were carefully increased, quantities necessary to obtain positive results had to be taken that, prior to the experiments, would have been regarded as toxic, if, indeed, not lethal. Thus tincture of aconite root varied from 4 or 5 of the conventional two to five minim doses, to as many half-teaspoonful or 30 minim doses, before the characteristic slowing of the pulse, respiratory oppression, gentle diaphoresis, numbness or tingling of the peripheral sensory fibers, and the somnifacient effects were obtained. The local sensory disturbance from contact with the lips and

tongue were caused before these were experienced in the extremities. Tincture of nux vomica varied from the conventional 15 to 20 minim doses to two teaspoonfuls hourly or every 40 minutes for 4 or 5 doses before the stimulation of the motor columns of the cord and the tension of the flexors of the legs were caused. Tincture of belladonna was the least variable, and conventional doses repeated, however, 3 or 4 times, were necessary to effect dryness of mouth, flushed face, augmented pulse rate, mydriasis, and interference with accommodation.

Tincture of strophanthus was conspicuously feeble in its action upon the heart, and, frequently before this characteristic action was secured, it was necessary to discontinue its use because the other associated active principles caused gastric disturbance, nausea, vomiting, and diarrhea. It could be taken in teaspoonful doses 3 or 4 times in the 4 hours with the certainty of causing gastrointestinal troubles, and a failure to markedly stimulate the circulatory system. With some specimens these wide differences in potency and effects did not obtain, and this instance serves to emphasize the variable therapeutic potency of the galenicals generally.

Tincture of digitalis like strophanthus was surprisingly variable, and to obtain the circulatory effects, doses were commonly so large and repetition so frequent that gastric disturbances occurred and compelled discontinuance. These tintures were set aside and a year later again subjected to a like test. This demonstrated a fact to which, if generally known, no serious attention is practically accorded, namely, and keep this well in mind, that galenicals in a year's time lose from 20 to 60 per cent. of their original therapeutic potency, whatever that may have been. No wonder, then, that some tinctures of aconite root and of nux vomica could be taken with perfect safety hourly for 4 or 5 consecutive doses, of from 30 minims, ½ a teaspoonful, of the former to 2 teaspoonfuls, 120 minims, of the latter.

Recognition of these facts resulted in abandonment of the galenicals and the prescribing of those active principles for which the various tinctures were classified, as for illustration, circulatory depressants, circulatory stimulants, spinal stimulants, mydriatics, somnifacients, spinal depressants, etc.

It is because of the prevalent conventional prescribing of galenicals at the present hour, and a knowledge of their unreliability that these remarks are submitted for your consideration. Suffice it to state that frequently when in consultation and confronting impending death from decompensation, and seeing the victim edematous, dyspneic, and sorely distressed, and taking conventional doses of tincture of digitalis or the infusion, or perhaps strophanthus and the ever-present consort nitroglycerin, digitalin, Germanic so called, or crystalline strophanthin administered in adequate doses would restore lost circulatory equilibrium,

dissipate the anasarca and pulmonary edema and re-establish renal function. Practically a useful and moderately active life was thus restored and, *with continued treatment,* prolonged for years, as experience has demonstrated and proven over and over again.

Search for the causes of this great variation in therapeutic potency discovered several, and among the principal will be first mentioned the long-established commercial evil, to wit, the employment of cheap and therefore inferior crude materials. What this means will be understood when the fact is made known that, for illustration, belladonna leaves were purchased at from 40 cents to 2 dollars the pound. Governmental regulation of this evil is suggested. Regarding this fact further comment is not required. Another and important cause was and largely is the absence of accurate methods of manufacture.

Reference to the Ninth Decennial Revision of the U. S. Pharmacopœia demonstrates this fact, and while there are evidences of an attempt to produce galenicals of approximately standard degree of potency, the latitude of variation is too great to render practicable, on the part of the practitioner, that accuracy of administration which depends upon a constant standard strength.

As galenicals are to-day, it is imperative that the clinician, in order to obtain positive and unquestioned results, *test the particular medicament he is administering* and thus learn and know what definite effects a given dose, other things being equal, will certainly accomplish.

Let us examine into why such care is essential by every physician for every tincture employed.

The U. S. Pharmacopœia directs for tincture of aconite root that 100 mils of the tincture should yield not less than .045 Gm. nor more than .055 Gm. of either soluble alkaloids (plural) of aconite. What, may it be inquired, *are* these alkaloids, and, how do they respectively affect the human organism?

Concerning tincture of digitalis it is directed that *if* assayed biologically, the minimum lethal dose should not be greater than .006 mil of the tincture or the equivalent in tincture of .0000005 Gm. of ouabain for each gramme of body weight of frog. Of this tincture .5 mil or 8 minims is the dose officially recommended. Here it may be remarked that, ouabain as prepared in sterile ampoules by a reputable manufacturing firm and marketed in boxes containing special directions as to the hypodermic administration of this supposedly powerful medicament, and cautioning that none but experienced clinicians should use it, and not repeat a dose until after several hours had intervened, was found to be inert in 4 times the dose recommended. Inquiry of the writer after a year had passed elicited the answer that the ouabain supplied was unreliable and practically worthless. The assertion was then vol-

unteered that reports from clinicians who used the drug were such that the manufacture of ouabain had been discontinued.

Tincture of gelsemium is directed to be prepared by percolation, using 100 grammes of crude drug and sufficient menstruum to make 1000 mils. Nothing is mentioned as to alkaloidal composition or strength of this galenical product. Tincture of nux vomica is to yield not less than .237 Gm. nor more than .263 Gm. of the alkaloids (plural and undesignated) of nux vomica. The menstruum for this tincture is composed of 3 volumes of alcohol and one volume of water, adjusting the finished tincture so that each 100 mils contain .25 Gm. of the alkaloids (plural observe) of nux vomica.

Tincture of opium should yield not less than .95 Gm. nor more than 1.05 Gm. of anhydrous morphine. What, may it be asked, of the other several principles present in variable percentage in each unit of the crude drug, and variable as to solubility respectively, in the menstruum used? These citations are self-explanatory and careful consideration must render it evident that the crude methods of manufacture must necessarily result in the supply of galenicals that vary in physiological activity as well as in the more or less associated alkaloidal and glucosidal components, as each unit of crude material employed happens to be composed.

Another cause for unreliability and variable potency is the *large quantity made at one time,* and the consequent age of the galenicals we see on the shelves of every pharmacy.

Not only is there a process of disintegration or some form of change that in time results in a loss—in a year's time, as above remarked, of from 20 to 60 per cent. of the original potency, but other conditions undoubtedly also contribute to this deterioration, such as exposure to light, temperature, and variations of humidity.

For generations clinicians have rested content to prescribe galenicals and administer them in conventional doses: If beneficial results were apparently secured they were content; if not, they likewise were content and enjoyed comfort in the belief or delusion that the failures were due to conditions which were beyond relief. It seems never to have occurred to them to ascertain with absolute certainty whether the galenical administered was a physiologically active preparation, or a tincture made of 40 cent. the pound crude drug, or of the 2 dollar the pound.

I venture to state that, at the present hour, if 25 physicians each wrote for the same galenical, and the prescriptions were compounded by 25 different pharmacists, there would be no two alike; furthermore that scarcely one of the 25 clinicians would attempt to familiarize himself with the potency of the tincture prescribed. How the use of active principles arose conjecture alone explains, but has not the almost un-

exceptional fear to administer them in *adequate* doses, and for a *sufficiently long period of time* resulted from the want of accurate knowledge of the galenicals?

Why do the text-books still advise, as well as the almost universal prescribing of inadequate doses continue?

Aconitine is given in doses of from 1/500 to 1/250 gr., strophanthin in similar dose, digitalin (Germanic) from 1/100 to 1/60 gr., although of late years we occasionally encounter a recommendation of 1/30 to 1/10 gr., scopolamine gr. 1/200, and so on. No wonder that experience, based on such almost impotent quantities, has caused the profession to be reluctant about the administration of active principles and to consider them useless.

To emphasize this fact reference is had to digitalin (Germanic), digalin, and strophanthin, physostigmine, hyoscine or scopolamine, gelsemine, etc. For years numerous patients dying of cardiorenalvascular disease, dying while subjected to treatment with galenicals, after having the designated active principles administered, taken in the order named in doses of from gr. ¼ to gr. ½ 3 or 4 times daily, and in emergency conditions 3-grain doses hypodermically in 20 c.c. normal salt solution, and from gr. 1/90 to gr. 1/120 3 or 4 times daily, have been restored to a fair degree of health and enabled for years, *during which time these medicines were more or less constantly taken,* to comfortably lead a moderately active and useful life. The much-feared cumulative action did not occur. In collapse in pneumonia, as in major operations, digitalin in normal salt solution has succeeded frequently.

The advantage of prescribing that active principle for which a galenical is selected, rests upon the fact that the numerous associated principles composing the crude drug are eliminated and many objectionable results thereby avoided.

In this age when the best and thoroughly reliable means to an end are a *sine qua non* for victory, is it not strange that the great profession of medicine remains content to rely upon an armamentarium that has been handed down from generation to generation, with apparently none, or at the best very feeble, efforts at betterment? Does not the practice of the present hour too commonly consist in prescribing this or that galenical in conventional doses? Is it a matter of surprise that the laity apparently too frequently obtain, as the expression is, just as good if not better results from osteopathy, neuromechanotherapy, chiropractic, napropathy, and other numerously named forms of massage, as from doctors?

If our viewpoint be true, has not the time arrived for the effort to be exerted for establishing scientific methods for the manufacture of

medicine that will possess a uniform and standard degree of physiological potency?

This involves correction at the very beginning, and demands the cultivation of medicinal plants; the gathering of the parts used for the production of reliable and active preparations, their manufacture in quantities that will insure against age, *i. e.* too long keeping and thus avoiding deterioration and relative uselessness; the keeping of finished products in environment that will not militate against their inherent efficiency, and, above all, the development and perfection of processes involved in manufacture, that will supply remedies of a reliable and standard degree of potency.

When these essential conditions will have become established, therapeusis will arise to the plane it should occupy in the world of Science, and its equally cultivated art will win from the public at large that confidence and trust which a truly scientific and skilled profession will merit.

260 South 16th Street.

THE THERAPEUTIC ACTION OF OUABAIN STROPHANTHIN GRATUS

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In the treatment of cardiovascular disease a great amount of experimental work and clinical investigation has been undertaken for the purpose of ascertaining the therapeutic action and individual indications of the different substances recommended for the relief of the subjective and objective symptoms of these patients. Our knowledge has widened particularly as regards the different alcaloidal principles of the digitalis group, whilst strophanthus tincture has not been so extensively investigated, and in the opinion of leading clinicians, such as Osler,[1] Dieulafoy,[2] Anders,[3] Forchheimer,[4] Hirschfelder,[5] plays only the rôle of a more or less doubtful substitute when digitalis preparations have failed in their therapeutic action. In the course of the past years, however, the general opinion has changed, and a glance at the transactions of this society of the past years reveals the awakening interest for the usefulness of strophanthus and the active substances such as the strophanthins. The valuable contributions of Satterthwaite,[6] Cornwall,[7]

and others are well remembered, and, without entering into a closer discussion of their papers, their studies have acted as an incentive for further clinical investigations.

A few introductory remarks may precede my casuistic contributions. Since Fraenkel and Schwartz[8] introduced in our pharmaceutical armentarium strophanthin as a valuable remedy, much work has been done, but as in other domains in science the euthusiastic reports of one particular remedy have been outweighed by less favorable and later reports. Some of the authors have warned against the indiscriminate use of such preparations, which medication even has been considered as the cause of fatal results (Hewlett,[9] Hochheim,[10], Chauffard,[11] Vaquez and Lutembacher[12]). The unstable action of the strophanthus preparations has been attributed to the various mixture of the active substances, and the aim of securing a more reliable product by extraction of the strophanthus seeds has been fully justified (Thoms, Fraser,[13] D'Arnaud,[14] Catillon[15]). The official strophanthus preparations are obtained from *Strophanthus kombe,* as well as Kombe strophanthin and its allied crystalline strophanthidin. D'Arnaud in 1888 first isolated a crystalline product which, derived from the *Strophanthus gradus,* he called the gratus strophanthin or ouabain, which he considered identical to the ouabain isolated from acocanthera. The crystalline form of the ouabain considered as a guarantee for its purity, its definite solubility, and the comparatively rapid absorption, a small or no tendency to cumulative action have been mentioned as an explanation for its most active qualities (Rowe[16]), compared with the strophanthin derived from the kombe strophanthus. Strophanthin kombe is understood to be a mixture of a crystalline and an amorphous acid strophanthin, differing markedly in their quantitative physiological activities, whilst ouabain is only one crystalline product. It must be remembered, however, that different samples of ouabain contain variable amounts of water of crystallization, a fact which seems to render its uniform activity doubtful. We must leave the final discussion of these differences to the experienced chemist and pharmacologist.

From the clinical standpoint the task is to ascertain the therapeutic value of a new remedy on the sick patient. Only a scant literature on the subject of ouabain is available. For further reference I would call attention to the papers of H. C. Bailey,[17] Catillon,[15] Vaquez et Lutembacher,[12] the last two contributors dealing with the French preparations. In an interesting study Bailey made on 47 cases at Bellevue Hospital, he recommends ouabain for intramuscular administration in a concentration of 1 :4000 saline solution, while for intravenous use the concentration is from 1 :6000 or 1 :8000, the maximum initial dose for the first 24 hours being from 0,00025-gramm (Vaquez et Lutembacher) or 0,0005

gramm according to Bailey. In the opinion of the last named author the crystalline strophantin-ouabain is considered as a valuable cardiac stimulant in cases of broken compensation, in chronic interstitial myocarditis, as well as in any form of chronic valvular disease. Ouabain as a remedy for cardiac emergencies ought to be used only by intramuscular or intravenous injection. It is not suited for continuous use and must be given under strict medical supervision or undesirable results will be the consequence. The dose should not be repeated within 24 hours and a repetition must be dependent upon the results of the first injection. Vaquez advises an interval of from three to four days between the different doses, which measure appears justified in doubtful cases. It is of interest to study this author's opinion of the use of ouabain d'Arnaud, and it is generally admitted that the active principles formerly used in the arrow poison of the Pahuins (Pelikan et Vulpain[18]) is a distinct heart poison which under certain circumstances also affects the striated, as well as the smooth, muscular fibers. Acting upon the heart muscle proper, it is supposed to render the slowed heart contractions more vigorous and also to increase the amplitude of the ventricular diastole. This action, interpreted as a selective one bearing directly upon the myocardium or by an intermediate effect upon the nervous system of the heart proper, seems to re-establish the impaired tonicity and contractility of the myocardial structures. Clinical evidence seems to substantiate these claims, particularly in instances of extreme cardiac insufficiency, attended by acute dilatation, pulmonary edema, and marked stasis in the portal system. As these manifestations may rapidly disappear under the use of ouabain, the result is more striking if previous to the cardiac stimulation a moderate venesection has been practised in order to relieve the extreme distention of the right heart, so permitting a more rapid contraction of the cardiac muscle.

Yet unexplained is the interesting relation of ouabain to the subsequent better effect of a digitalis therapy. While digitalis, when applied first, would only in exceptional instances give any results at all, it appears to become reactivated when given subsequently, or it will keep up effectively the primary favorable results of the ouabain medication. Cases are on record which show this effect for weeks or months afterward. The action of the ouabain upon the vessels, if any, can be admitted, is only slight; an action upon the renal functions is not conspicuous. The recommendation of Danielopoulo[19] and others may be recorded advising the combined administration of theobromine or of nitroglycerin with ouabain, the latter in instances of attending hypertension. It is claimed that the only signs of intolerance consist in nausea and vomiting (Hochheim, Chauffard, Vaquez) which may be the result of an overdose and may be avoided by a more careful administration of

the drug. While using ouabain, as well as strophanthin, we must not forget the marked irritative qualities of that drug when brought in contact with injured tissue, leading to marked inflammation of the latter, even to abscess formation. Therefore deep muscular injections into the gluteal muscles are advisable, but these may become quite painful within a half hour of the administration. Bailey's advice of subsequent massage of the injected muscle is reasonable, since pain and irritation can so be avoided. Also when resorting to intravenous administration one must avoid varicose veins, for such inelastic vessels are more easily injured leading to perivascular infiltration. Supposed the intravenous administration is the method of choice, the needle should enter the vessel in its longitudinal axis, so to avoid a pricking and injury to the opposite vessel wall, leading to an undesirable periphlebitis. The occurrence of chills following the intravenous and intramuscular introduction of the drug, mentioned by Fraenkel and Schwartz and Bailey must be regarded as a rare occurrence. Hewlett's observation of heartblock following the use of strophanthin is not the only observation so far published, Vaquez and Lutembacher admitting such a possibility, however, they mention instances in which arrhythmias existing before the ouabain medication were corrected and were absent after the treatment, for which peculiar occurrence no explanation has been given as yet.

Although in my hospital work I have had no opportunity to control the therapeutic action of ouabain by a series of pulse and cardiographic tracings, as published in the papers of Bailey and Vaquez and Lutembacher, my observations have been restricted to the study of pulse, blood pressure, size of the heart, ascertained by palpatory percussion, the character of the heart sounds, and the record of the symptomatic subjective complaints of the patients so far studied. Notwithstanding these handicaps of instrumental records, some information may be abstracted from my case study.

The ouabain preparation at my disposal were the sterile ampoules containing the crystalized substance in a dilution from 1 :4000 of sterile saline. The contents of the ampoules, assayed pharmacologically corresponded to 0.0005 gramm of the active crystalline body; the injected dose varied from one to two cubic centimeters, given intramuscularly or intravenously. With the exception of one case, the injection was in all instances well borne. In one instance (Case II) a perivascular infiltration was noticed for several days much complained of by the patient on account of pain and swelling. As a rule the patients were kept at absolute rest in bed, with liquid diet in restricted amounts, keeping the patient as far as possible from exertion or nervous or other excitement. Since in my practical work I encounter so many cases of myocardial degeneration complicating or coexistent with pulmonary disease, the

clinical study of these cases was of much interest in the hope of learning the effect of ouabain in such cases. We all are aware that in pulmonary tuberculosis with a chronic more or less fibrous process the heart reaches a stage in which all or most of the cardiovascular stimulants known are unable to supply the asthenic and toneless myocardium with the necessary contractile power to fight successfully against the intrinsic and extrinsic obstacles of impaired circulation.

As in other publications upon ouabain therapy, my study deals with cases of valvular, endocardial, and myocardial insufficiency. Such a subdivision is justified by various reasons, etiologically and objectively, for from the standpoint of prognosis and treatment these cases offer distinct differences.

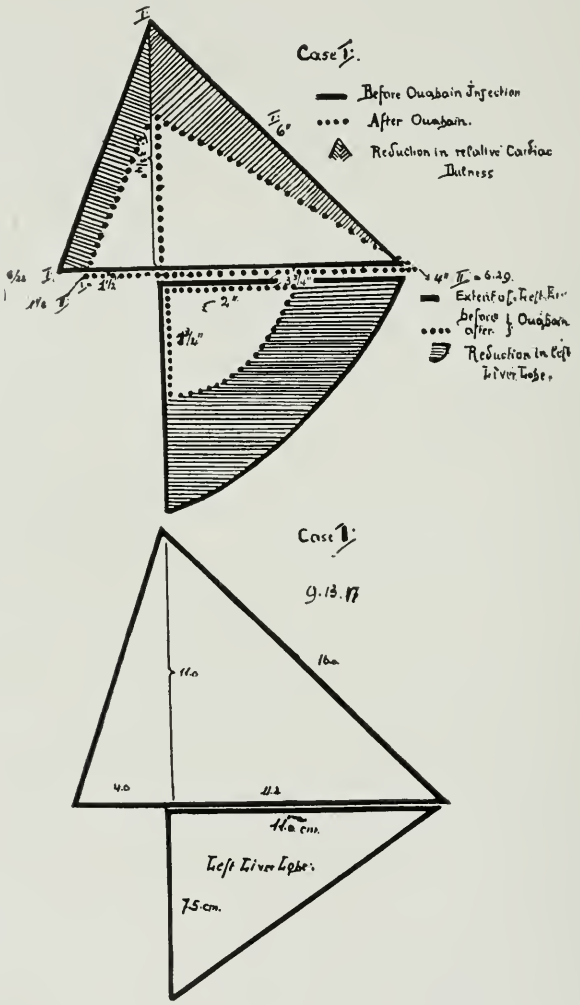
Of the cases of valvular lesions with incompensation the following are reported:

Case I.—J. McD., colored boy, age twelve years, admitted January 2, 1917. The family history was negative. He complains of persistent cough for past three weeks with anorexia, but no symptoms suggestive of a cardiac condition. Physical findings on admission: well nourished, slight subfebrile temperature not in excess of 100.8° F., marked tachycardia, oscillating from 128 to 192 at rest, considerable dyspnea, respiration at rest 42 to 44 per minute. Chest: bulging precordium, diffuse apex beat extending from the fifth intercostal space over an area 2 inches in diameter toward the axilla and the sternum. Distinct thrill over apex. Relative cardiac dullness: 9.4 cm. to left, 3.7 cm. to right from the midsternal line. Transverse diameter 13.1 cm. Upper border of third intercostal space overlapping the right Sternal border 1.3 cm. Height 9.3 cm.—xiphoid process to upper border of third rib. Oblique diameter 12 cm.; cardiac triangle of relative dullness 60,915 square centimeters. Auscultation in fifth intercostal space reveals a double murmur involving systolic and diastolic phase, harsh, blowing, transmitted toward the posterior axillary line, considerable shortening of systolic-diastolic interval. First tricuspid sound substituted by blowing murmur, second pulmonic sound and first aortic sound normal, distinct murmur replacing the second sound. Pulse rate, at rest, 120, fair volume, fairly regular; ascending wave sudden, succeeded by rapid fall (Corrigan pulse), volume fair. Lungs: impaired percussion over both apices, as far as first intercortal space anteriorly and third intercostal space posteriorly, on right side, to upper third of scapula on left side. Inspiratory sounds harsh, a few inspiratory crepitant rales; accentuated, prolonged expiration, pronounced pectoriloquy coincident with extent of percussion changes. Right base anteriorly, below the seventh intercostal space posteriorly, impaired percussion note, distant respiratory sounds, no movable dullness present. Liver dullness considerably enlarged, especially of the left lobe extending far below the xiphoid process and toward the left hypochondrium. Increase of liver consistency, surface smooth, slightly tender on pressure. Urine high specific gravity, no albumin nor casts. Sputum mucoid, negative for tubercle bacilli on repeated examination; diplococci and *Baccillus catarrhalis* present, few lymphocytes and mostly neutrophille cells.

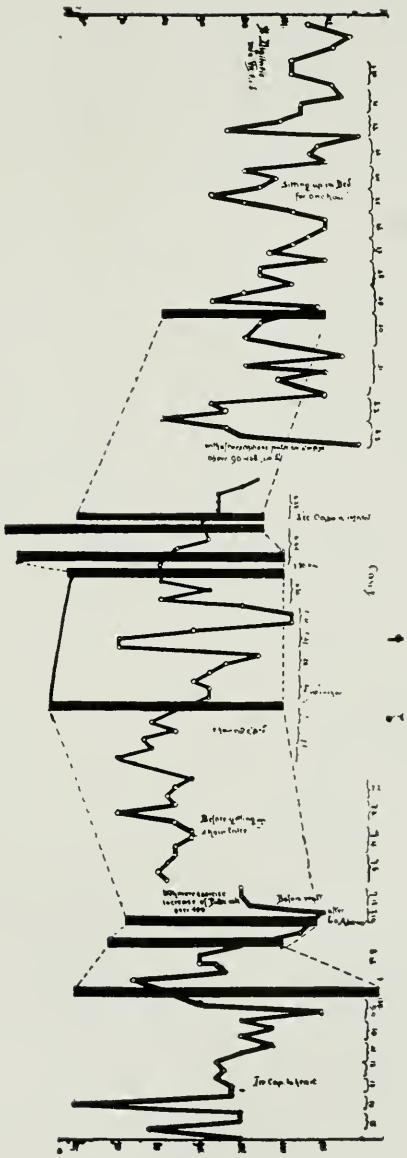
Symptomatic treatment of patient's cough, enforced bed rest for three weeks following admission. Cardiac stimulation consisting of tincture of digitalis 8 minims, t. i. d. Blood pressure, 10 days after start of digitalis: systolic, 120 mm., diastolic

80 mm., pulse pressure 40 mm. Hg.; pulse rate 104, cardiac activity pro one minute 21,600 mm. Hg.

Pulse rate, notwithstanding the digitalis medication, persisted in being high, only on the fourth day falling to 94. The least exertion caused rapid and very irregular pulse, persisting several days following the sitting up of the patient. Blood pressure



readings were in accordance with the unstable pulse rate. Average pulse rate 128 to 90 heart beats. On June 22: persistent enlargement, 9.5 cm. to left from midsternal line, 3.8 cm. to right; transverse diameter 13.2 cm. Height 9.7 cm.; oblique diameter 15.5 cm.; surface of cardiac triangle, 64.02 square centimeters. Absolute bed rest was ordered. An injection of 2 c.c. of ouabain intravenously into the right arm, causing no trouble nor later inflammatory symptoms.



Blood pressure preceding injection found at systolic ausculatatory reading 105 mm. Hg., diastolic 40 mm., pulse pressure 62 mm. Hg., pulse rate 90, cardiac activity per one minute 13,320—considerably lower than on the former occasion. On the following day considerable lessening of pulse rate was noticed, a drop reaching 94 to 90 and 84 in the evening. The blood pressure on the following day registered systolic 110 mm. diastolic 46 mm., pulse pressure 64 mm., pulse rate 84, cardiac activity pro one minute 13,304—just slightly less than on previous occasion. Pressure readings the same day in the evening: systolic 110 mm., diastolic 48 mm. Hg., pulse pressure 62 mm., pulse rate 80, cardiac activity per one minute 12,640—the lowest figure so far encountered in this instance. The pulse quality was softer, ascending wave far better sustained, regular, no more extrasystoles nor irregularities present. The change in the cardiac size is seen from Chart I. 10.2 cm. to the left, 3.8 cm. to the right from the midsternal line, transverse diameter 14 cm. Height 6.1 cm., oblique diameter 14.4 cm., cardiac triangle of relative cardiac dullness 42.7 cm., demonstrating a reduction of 21.62 square centimeters or 33.7 per cent. less than 24 hours before. Whilst the right ventricle had mostly contracted, the left ventricle suggested a slight displacement to the left with a marked reduction in the height of the heart. As a further consequence of the ouabain action the reduction in the extent of the left liver lobe will be noticed. The lateral diameter of the liver lobe was 5.1 cm., corresponding to a reduction of 4.5 cm., the distance from the xiphoid process was 4.8 cm. or 4.1 cm. less than on the former occasion. Considering the left liver triangle we have a reduction of 30.48 square centimeters or 35.09 per cent. We are permitted to think of a considerable relief in the portal stasis.

The apex beat was less diffuse, more forcible in its action. A lessening of the mitral murmurs, their softer nature, a lesser radiation toward the axilla became manifest. The tricuspid murmur, softer in character, was still noticeable in the anterior axillary line, greater accentuation of the second pulmonic sound and added to the same a soft diastolic murmur over the pulmonic as well as over the aortic area must be recorded.

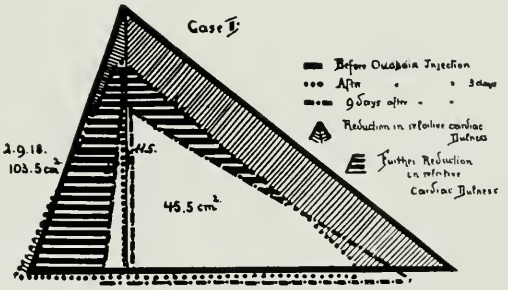
For the following two days the pulse rate fluctuated between 92 and 80, after that the irregular rate and frequency with an occasional rise to 112 on June 26 was noticed. After June 28 the pulse rate was reduced gradually to 94—88 on June 29. Pressure readings on the same date gave for systolic 110 mm., diastolic 54 mm. Hg., pulse pressure 56 mm., a pulse rate of 72, cardiac activity 11,808 mm. The further contraction of the heart was found 10.2 cm. to the left, 2.9 cm. to the right from the midsternal line, transverse diameter 13.1 cm., height 4.8 cm., oblique diameter 11.9 cm. The cardiac triangle of relative dullness corresponding to 34.44 square centimeters showed a reduction of 31.58 square centimeters or 49.3 per cent., as compared with that before the ouabain was given, 15.6 per cent. being added to the reduction recorded 5 days previous. Later, however, a tendency to dilatation of the cardiac muscle was anticipated, showing that ouabain may give a fair immediate, but not always persisting, reduction in the size of the heart unless the medication is repeated or followed up by a protracted cardiac stimulation. The left liver lobe maintained its reduced size, extending 5.1 cm. to the left from the midsternal line and 4.5 cm. below the xiphoid process, the left liver triangle corresponding to 11,475 square centimeters, demonstrating a reduction of 31.25 square centimeters, or 73.1 per cent., in addition of 38.1 per cent. to the former measurements. The heart sounds were rougher, more intense in character and the murmurs could be traced over a larger district than on the previous examination. After June 30 a slowing of the pulse rate was noticed, the maximum being 88, the minimum 70.

Gradual exercise was permitted, but on each occasion a considerable increase of the rate up to 120 a minute was the result, with a lower reading of both systolic and diastolic pressures.

The patient did not receive any further cardiac medication, the high pulse rate persisting while the patient's exercise was unrestricted. A marked rise of the systolic pressure 134 mm., diastolic pressure of 60 mm., pulse rate 74, cardiac activity 14.356 mm. Hg., or an increase of 24.7 per cent. over the minimal activity was the result. Two months later the following cardiac diameters were found: 11.2 cm. to the left, 3.8 cm. to the right from the midsternal line or transverse diameter 15 cm., height 11.1 cm., oblique diameter 16.3 cm., cardiac triangle of relative dullness 61.05 square centimeters, only 2.97 square centimeters less than before the ouabain medication, representing 4.63 per cent. below the first measurements.

In résumé we may say that in this instance the ouabain medication was followed by a temporary improvement in the reduction of the size of the heart, in the slowing of the pulse, in the rise of blood pressure, the considerable relief of dyspnea, the reduction of the left liver lobe, the improvement of the manifest stasis in the portal system. In order that these valuable and rapid changes may be persistent we must give careful supervision to the case and further cardiovascular stimulation through digitalis and allied preparations, guarding the patient against recurrences from cardiac dilatation; for this, if overlooked, may mean lasting damage by exhaustion of the cardiac reserve strength.

Case II.—Mrs. F. E., colored, age 27 years, single, cook. Family history negative. After an operation of cystic goiter in September, 1917, she suffered from anasarca, dyspnea, and cough, with abundant mucoid expectoration. After treatment for several weeks at another institution patient improved, but since February, 1918, has been confined to bed on account of cardiac failure attended by considerable anasarca, dyspnea, and bloody expectoration. Admitted to our hospital on February 9, 1918.



Physical findings on admission, very stout patient, sitting in upright position, very dyspneic, cyanosis of lips, considerable anasarca of upper and lower extremities, abdomen distended by fluid. Heart examination: apex beat diffuse in sixth interspace, outside of midclavicular line, relative cardiac dullness 14 cm. to the left and 4 cm. to the right from the midsternal line, height 11.5 cm. Oblique diameter 22.5 cm., transverse diameter 18 cm. Area of relative superficial cardiac dullness 103.5 square centimeters. Heartsounds: First mitral sound indistinct murmurish in character, second sound indistinct; first tricuspid sound indistinct and distant;

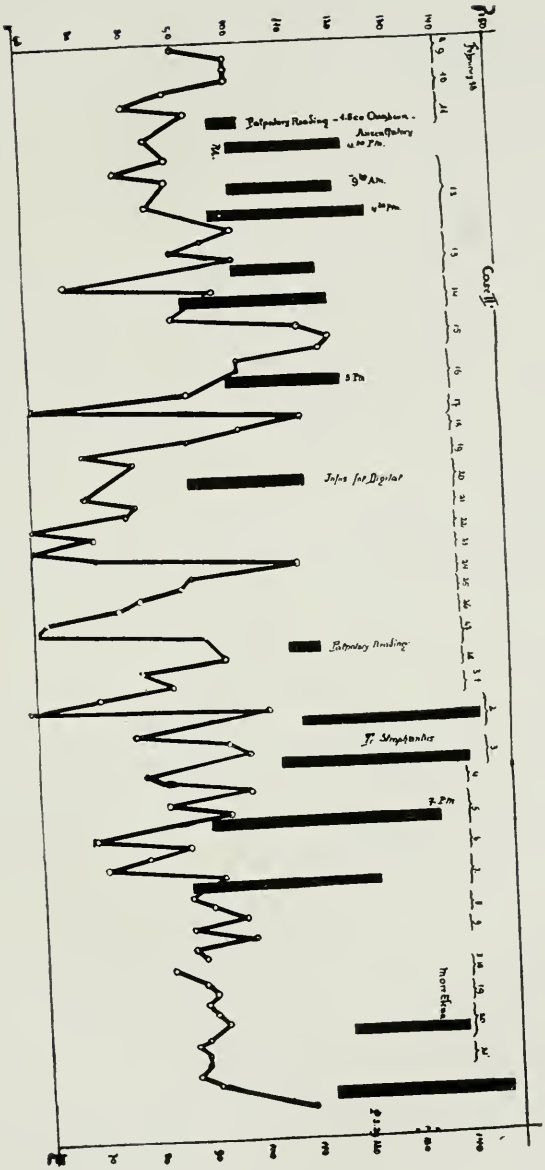
second pulmonic sound booming and markedly accentuated; aortic sounds nothing abnormal. Pulse very rapid and irregular, 100 a minute. Pulmonary findings: Extensive pulmonary stasis with numerous moist and diffuse rales. Sputum examination negative for tubercle baccilli, diplococci present. Urine: trace of albumin, several hyaline and granular casts.

The patient was kept under absolute bedcare, liquid diet, ice bag being applied over the heart, Tincture of strophantus, 10 minims t. i. d., given for the next two days. The pulse had become a little slower, but on February 11 the blood pressure reading, obtainable only by the palpatory method being very low—102 mm. —diastolic value was not obtainable. Ouabain solution (1.5 c.c.) was injected intramuscularly. Three hours later the blood pressure readings obtained on the left arm by the ausculatory method were 122 mm. systolic, 100 mm. diastolic, pulse pressure 22, pulse rate 84; cardiac activity pro one minute 18,648 mm. The patient felt more comfortable; she was less embarrassed in talking, less dyspneic, the night being more restful. The following day at the site of injection of the left arm a moderate swelling and tenderness was noticed, so the bloodpressure readings refer to the right arm. At 9 A. M., 18 hours after the injection, the pulse rate was 88 systolic reading 120 mm., diastolic 100 mm., pulse pressure 20 mm., cardiac activity pro one minute 19,360 mm. Twenty-four hours after the injection the pressure registered over the same area 126 mm. systolic, 96 mm. diastolic, pulse pressure 30 mm., pulse 84, cardiac activity 18,648 mm. As it was desirable to watch the exclusive action of the ouabain injection, all other cardiac medication was discontinued. Two days later the systolic pressure had declined a little, 116 mm., the diastolic reading was found at 100, leaving only 16 mm. for the pulse pressure with a pulse rate ranging at 100, cardiac activity pro one minute of 21,600 mm. Hg. Evidently the heart was working excessively with the imminent danger of cardiac failure.

Three days after the ouabain injection the size of the heart was found reduced, relative cardiac dullness extending 9.5 cm. to the left, 4.7 cm to the right from the midsternal line, representing a transverse diameter of 14.2 cm., or 3.8 cm. less than on the previous examination. The height measured 9 cm., or 2.5 cm. less, the oblique diameter was found at 14.8 cm., or 7.7 cm. less. Taking in account the area of the relative superficial cardiac dullness representing 63.9 square centimeters, or 39.6 square centimeters, or one-third less than on the previous examination. On auscultation the mitral murmur replacing the first sound was more manifest and radiated further toward the left axilla; the second pulmonic sound was still markedly accentuated, aortic sounds indistinct.

The blood pressure readings on the same day revealed for the systolic reading 118 mm., for the diastolic 90 mm., the intermittent 1, easily depressible pulse rated at 96, cardiac activity pro minute 19,968 mm., a figure far above the normal cardiac function.

As seen from the pulse chart, the pulse rate was still in excess and exceeding the one hundred mark, especially noticeable after the least excitement of the patient. On February 20, nine days after the ouabain injection, the pressure was found at 112 systolic, at 90 mm. diastolic, pulse pressure 22, the pulse rate 108, cardiac activity 21,816 mm. Hg. pro minute. The diameters of the relative cardiac dullness were as follows: 12 cm. to the left, 1 cm. to the right from the midsternal line, representing a transverse diameter of 13 cm., a height of 7 cm., an oblique diameter of 15 cm. The triangular area of the relative cardiac dullness comprised 45.5 square centimeters.


Palpebary Reading – 4 Sec Complete –
Ancon Pulsary
9 Am.
9 Pm.
Jolse for Digital
Palpebary Reading
Tr Strophanthus
7 Pm
Montreal

These results compared with the former findings evidently suggested a considerable change in the size of the heart which could be noticed very soon after the injection of ouabain had been given. Also with regard to the blood pressure readings the difference could not escape attention, since the auscultatory pressure readings were possible only after the injection.

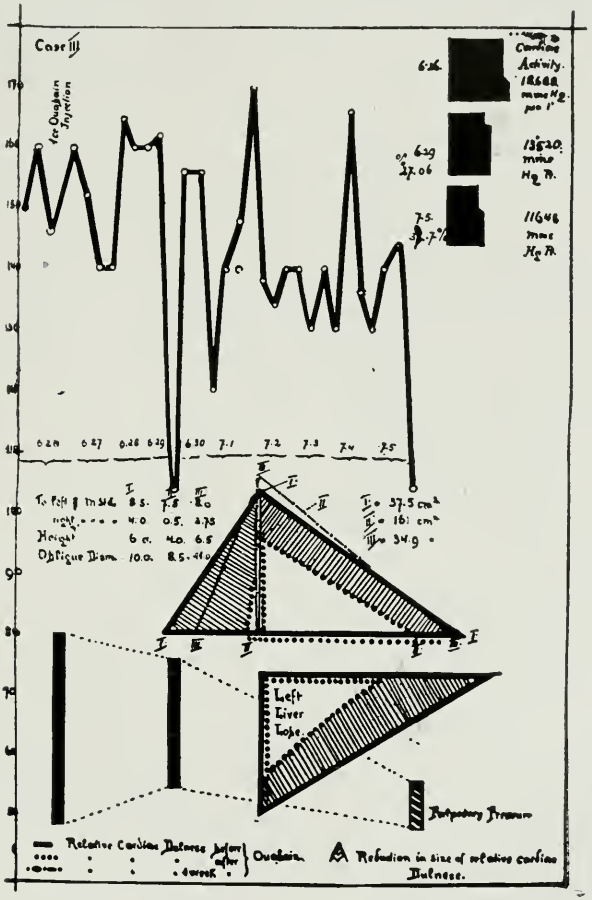
This case is of particular interest since ten days after the first treatment we tried the patient's cardiac function whilst under the influence of an infusion of 15 grains of powdered digitalis leaves in 6 ounces, a dose of 1 dram being given t. i. d. The patient at first did not tolerate the medication very well, as vomiting occurred, attended by a very weak and irregular pulse, and pressure readings were obtainable only by the palpatory method on February 27. On March 2, the pulse was found stronger, rate 104, systolic pressure 144 mm., diastolic 110 mm., pulse pressure 34 mm., cardiac activity 26,416 mm. Hg. pro minute. On that date the digitalis medication was dropped and substituted by tincture of strophanthus 10 minims t. i. d. In the course of that medication there occurred a slightly lessened pulse rate attended by a lowered systolic as well as diastolic pressure. At a later period (three weeks later) both pressure readings became higher, particularly the diastolic readings remained above 100. The anasarca which at first had receded, increased again, causing considerable distress to the patient, who required the administration of morphine, gr. ¼, and atropine, gr. 1/120, for the temporary relief from the marked dyspnea. The patient died on March 29. The postmortem examination revealed atheromatous degeneration of the aortic valves, chronic endocarditis of the left ventricle, besides thickened bicuspid valves, myocardial fatty degeneration, chronic passive congestion of the liver, gallstones, chronic congestion of the spleen, chronic interstitial nephritis, moderate hydrothorax, hydropericardium, a few chronic adhesions of the right pulmonary apex and ascites.

Case III.—E. M., white girl, age nine years, admitted June 26, 1917. Incomplete history obtainable from mother of child relative to acute onset of disease with chill and fever three weeks ago.

Physical findings: White, female patient, very exhausted and dyspneic, sitting in upright position, cardiac region bulging, diffuse apex beat in fifth interspace, in midaxillary line. Relative cardiac dullness extending 8.5 cm. to the left, 4 cm. to the right from midsternal line, transverse diameter 12.5 cm., height 6 cm., oblique diameter 10 cm., cardiac triangle of relative cardiac dullness 37.5 square centimeters. Distinct thrill present over cardiac area. Heart action rapid, pounding second pulmonic sound. Diffuse moist gurgling rales all over the chest render the interpretation of the cardiac sounds very unreliable. Pulmonary findings of congestion and diffuse bronchitis with stasis over both bases. Marked cyanosis of lips and upper extremities. Left liver lobe markedly enlarged, extending 10 cm. to the left from the midline and 6½ cm. below the xiphoid process. Blood pressure: systolic 80 mm., diastolic 48 mm., pulse pressure 32 mm., pulse rate 146. cardiac activity 18,688 mm. Hg. pressure per minute. The patient when first seen was given immediately one intravenous injection of 1 c.c. of ouabain. The patient stood the injection very well, apparently feeling relief from the extreme cardiac distress. The following changes in the extent of the cardiac dullness were recorded the next day. Transverse diameter 8 cm., 7½ cm. to the left from the midsternal line, ½ cm. to the right from the midsternal line, height 4 cm., oblique diameter 8½ cm., cardiac triangle of superficial dullness 16 square centimeters, or 21.5 square centimeters less than on the preceding day. The heart sounds were better sustained, but no murmurs could be detected. The left liver lobe extended

5 cm. to the left from the midsternal line and 4½ cm. below the xiphoid process. The pulse was still frequent, ranging at 140 per minute, showing a slight reduction in the rate. The pulmonary findings revealed a moderate improvement with less moisture, but still pronounced harsh, almost tubular, breathing over both apices.

One week later without any further cardiac stimulation the heart showed the following size for the relative dullness: Transverse diameter 10¾ cm., extending 8 cm. to the left, 2¾ cm. to the right from the midsternal line. Height 6½ cm.,



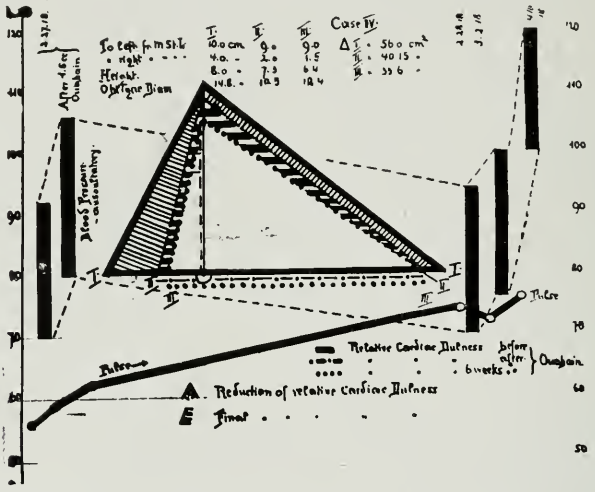
oblique diameter 11 cm., cardiac triangle of superficial dullness 34.93 square centímeters, a figure only 2.6 square centimeters below the first measurements obtained. The pulse was hardly perceptible, 138 per minute, only palpatory blood pressure readings could be made; systolic pressure was 56 mm., diastolic 48 mm., with a pulse pressure of 8 mm. The patient was very uncomfortable and dyspneic, probably also on account of the more marked pulmonary stasis. This patient developed symptoms of poliomyelitis and consequently was transferred to the neurological service of our city institution.

It must be added that on June 29—three days after the ouabain injections—the pulse rate was found at 104, with a systolic pressure of 76 mm., a diastolic reading of

54 mm., a pulse pressure of 22 mm., a cardiac activity pro one minute of 13,520 mm. The clinical impression of this case treated with ouabain was not very favorable since, notwithstanding the considerable reduction in the size of the heart following the medication, the dilatation noticed one week after, suggested that evidently the heart had not sufficient strength to cope with the difficult task of overcoming the increasing venous stasis.

In several cases of myocarditis without valvular lesions ouabain medication was tried, and a few instances may be briefly recorded.

Case IV.—J. B., age thirty-five years, machinist, was suffering from active pulmonary tuberculosis involving both upper lobes and the base of the right lower lobe. Sputum at various examinations positive. On account of dyspnea and general weakness, the patient's heart examination of February 27 showed the following diameters for the relative cardiac dullness: transverse diameter 14 cm., 4 cm. to the right, 10 cm. to the left from the midsternal line; height 8 cm., oblique diameter

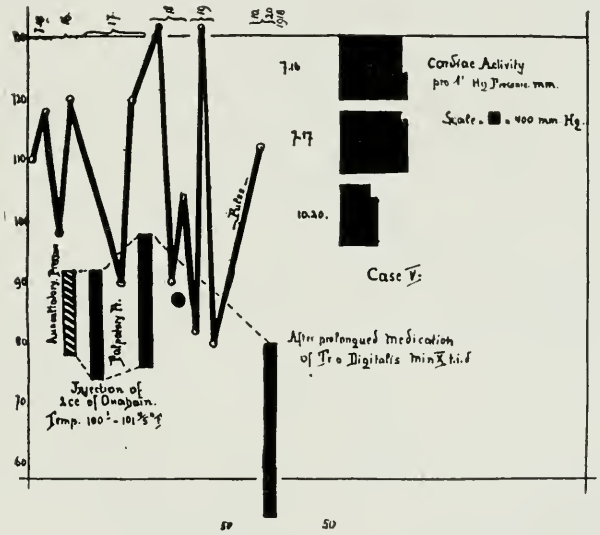


14.8 cm., cardiac triangle of superficial relative dullness 56 square centimeters. Heart sounds, with the exception of the indistinct first tricuspid sound, normal. Pulse rate 56 at 10 A. M. Blood pressure, systolic 92 mm., diastolic 70 mm., pulse pressure 22, cardiac activity pro one minute 9,072 mm. Hg. pressure. At 2 P. M. on the same day ouabain solution, 1.5 c.c., was given intravenously, which medication was well borne by the patient. Four hours and a half later the pulse was found at a rate of 58 pro minute, the systolic pressure 106 mm., diastolic 80 mm., pulse pressure 26, cardiac activity pro one minute 10,788 mm., distinctly better than on the former determination. On the following day, the patient being still kept in bed and under exclusive milk diet, the following pulse and pressure readings were found: pulse rate 74, systolic 94 mm., diastolic 70 mm., pulse pressure 24, cardiac activity pro one minute 12,326 mm. Hg. pressure about one-third higher than on the first examination. This result was confirmed by the heart examination four days later, showing a reduction in the transverse diameters of 11 cm.—9 cm. to the left, 2 cm. to the right from the midsternal line; height 7.3 cm., oblique diameter 10.5 cm., cardiac triangle of relative dullness 40.5 square centimeters, or one-fifth less than on the previous examination. The first mitral sound was better sustained, the first tricuspid

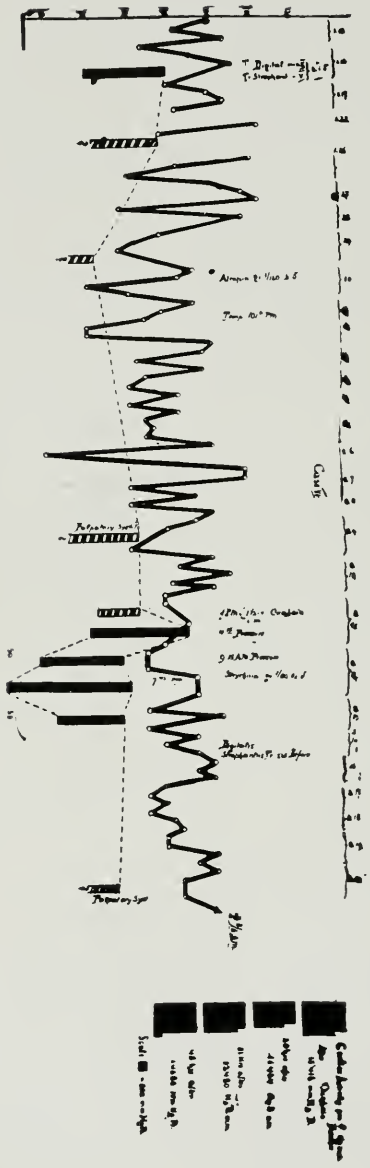
sound had become normal. Blood pressure, auscultatory, 100 mm. systolic, 76 mm. diastolic, pulse pressure 24, pulse rate 72, cardiac activity per one minute 12,672 mm. Hg. With the palpatory method higher figures were recorded. The patient felt much better and, the dyspnea having disappeared, was anxious to resume his exercise. This was granted only in restricted amounts. Six weeks after the one dose of ouabain, the patient taking light exercise, the heart had preserved its minimal size, a transverse diameter of 10.5 cm., a height of 6.4 cm., an oblique diameter of 12.4 cm., or a cardiac triangle of 33.6 square centimeters. When last seen the patient's blood pressure ranged at 120 mm. systolic, 80 diastolic, pulse pressure 40, pulse rate 76, cardiac activity per one minute 15,200 mm. Hg.

If in the preceding case the ouabain medication gave a favorable result, it must be admitted that in other instances of advanced myocardial degeneration the therapeutic effect, if obtainable, is not very striking and only temporary. Such instances also occurred in our observation, a few examples of which may be cited.

Case V.—Miss F. E., Age 26, suffering from pulmonary tuberculosis involving all lobes for the past seven years. Positive sputum, slight febrile evening temperature not exceeding 101°. Patient is frequently dyspneic even while at rest. Relative



cardiac dullness found extending 9 cm. to the left, 0.5 cm. to the right from midsternal line; height 7.5 cm., oblique diameter 11.5 cm., cardiac triangle of relative dullness 35.62 square centimeters. First tricuspid sound split, markedly accentuated, second aortic sound reduplicated, snappy; also reduplication of second pulmonic sound. Pulse 120, irregular, depressible; systolic pressure left arm 92 mm., auscultatory, 78 mm. diastolic, pulse pressure 14 mm., cardiac activity per one minute 20,400 mm. Hg. pressure. Four hours after intravenous injection of 2 c.c. of ouabain, with a pulse rate of 120, the systolic pressure was 92 mm., diastolic 74 mm., pulse pressure 18 mm., cardiac activity per minute 19,920 mm. Hg. pressure. On the following day no difference in the size of the heart could be noticed, the split first tricuspid sound was no more heard, the heart sounds remained forcible. Pulse rate remained



the same; systolic auscultatory sound registered at 98 mm., diastolic 76 mm., pulse pressure 22 mm., cardiac activity 20,880 mm. Hg. pressure. There was no further change noticeable as regards the patient's pulse rate nor with regard to the general weakness and dyspnea.

At a later date digitalis medication, 10 minims, t. i. d., of the tincture, had no influence either upon the pulse rate or upon the blood pressure, or on the size of the heart, which organ on *x*-ray examination showed diaphragmatic adhesions and displacement toward the left.

Case VI.—J. L., white patient, tailor age fifty-eight years, suffering since January, 1917, from chronic bronchitis, which later was diagnosticated as pulmonary tuberculosis with involvement of all lobes. Positive sputum, slight febrile evening temperature, with tachycardia. About January 9 the presence of edema of the lower extremities was found; heart sounds were indistinct and distant, no particular enlargement of the heart, transverse diameter 10.8 cm., 10.3 cm. to the left, 0.5 cm. to the right from the midsternal line; height 7 cm., oblique diameter 11 cm. From January 16 to 22 the patient while receiving tincture of digitalis, 10 minims, and tincture of strophanthus, 5 minims t. i. d., his condition became worse; the pulse was found very indistinct, blood pressure obtainable only by the palpatory method, only systolic reading of 88 mm. being found. On February 9 systolic pressure only was obtained—palpatory 88 mm., pulse 88, patient being kept in bed rest with liquid diet. On February 11 at 1 P.M. the same findings prevailed. An injection of 1.5 c.c. of ouabain was made into the muscles of the arm. Three hours later the pulse registered 94 auscultatory pressure, systolic was 94 mm., diastolic 70 mm., pulse pressure 24 mm., cardiac activity 15,416 mm. Hg. pressure pro minute. At that time the heart sounds had become more distinct, with marked accentuation of the second pulmonic and aortic sounds, apex beat felt inside of the left midclavicular line. On the following day, twenty hours after the medication, the pressure and pulse were recorded as follows: pulse 84, fairly well sustained, systolic 78 mm., diastolic 58 mm., pulse pressure 20 mm., cardiac activity pro one minute 11,424 mm., and on the evening of the same day pulse, 96, systolic 80 mm., diastolic 50 mm., pulse pressure 30, cardiac activity 12,480 mm. Hg. pressure. On February 13, two days later, with a very high pulse rate at 102, the systolic pressure was only 78 mm., the diastolic 62 mm., pulse pressure 16 mm., a cardiac activity of 14,280 mm. After that date an attempt with the same strophanthus-digitalis medication had no beneficial influence whatsoever, edema and anasarca became more manifest, blood pressure readings were obtainable only with the palpatory method, 76 mm. being the maximum found on February 20. The patient died on March 2 from cardiac failure.

So far my observations on cases of acute and chronic endocarditis and a few cases of chronic myocardial degeneration. A few more cases could be added to those already mentioned. However, a great number of observations are required for a conclusion as to the therapeutic value of a new remedy and in my casuistic contribution only a few points may be mentioned. In the short study we may subdivide the results into those which became evident shortly after the remedy had been given and into the ultimate changes which appeared only later. Furthermore we must be guided by the nature of the pathological lesions, whether they are associated or not with affections of the endocardium, the myo-

cardium, or whether we have to deal with an acute or chronic process with symptoms of a systemic infection.

Among the immediate obvious changes to be expected after ouabain injection we see the improvement of the blood pressure which before could hardly be obtained by the palpatory method and frequently for the systolic value only, once the remedy had been given we could ascertain with the auscultatory method the systolic as well as the diastolic threshold. Under favorable conditions we may expect a distinct rise in the diastolic pressure (Cases I, II, IV) within the first 24 hours, which rise ought to persist for several days over the initial figure. The change in the diastolic pressure is less conspicuous but apparently a reduction in that value may be looked upon more favorably than a rise. Where a tachycardia becomes less, or approaches more normal figures, and where a bradycardia equally approaches the normal rate, this ought to be interpreted favorably. Considering the cardiac activity, cases with a high pulse rate and a low pulse pressure frequently are unfavorable as to the final outcome.

In instances of cardiac hypertrophy and dilatation a considerable reduction in the extent of the relative cardiac dullness can be anticipated (Cases I, II, III, IV), but such a reduction does not mean a constant result nor a definite promise for the effectiveness of the cardiac medication. As seen in Case III, where a high septic temperature complicated the outlook, an initial reduction in the size of the heart would not be maintained against the cardiac overstrain.

Incidentally, with the improvement of the circulation a decided reduction in the extent of the left liver lobe could be noticed (Cases I, II, III).

With reference to the heart sounds reduplicated sounds may disappear and extrasystoles may equally vanish, while cardiac murmurs are not liable to change in character.

The nature of the pathological lesion, whether endocardial, associated with marked hypertrophy and tending toward dilatation, or due to an already degenerated myocardium, has a great bearing upon the final results. The first mentioned instances appear favorable for the use of ouabain medication, particularly when haste is required to stimulate the contraction of the dilated and distended cardiac muscle previous to the effect of digitalis medication which requires a longer time to become manifest.

Wherever we have to anticipate a toxic myocarditis and extensive degeneration—due to age or other factors—we may try the ouabain without expecting too much from it. Just as in other instances where the reserve energy of the myocardium has been exhausted a forceful stimulation of the cardiac muscle may accelerate the fatal issue.

In the cases submitted for discussion it will be remembered that only one dose of ouabain had been given; this was for the purpose of finding out how long this one dose of the drug would show its therapeutic action if such action could be observed. The question arises when and how often can we repeat the dose and with what effect. Other cases are being studied and a later report is anticipated; for the present, however, it seems to me that fresh samples of ouabain very likely deserve our attention from the therapeutic standpoint as a possible means of administering effectively to cases of cardiac deficiency.

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THE THERAPEUTICS OF PHENYLCINCHONINIC ACID

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This remedy, first described by Doebner and Gieseke and tested clinically by Nicolaier in 1908, has been before the medical profession as a controlled product since 1910. Its extensive use and the excellent results obtained from its employment led to its incorporation as phenylcinchoninic acid in the ninth edition of the United States Pharmacopœia, which became official September 1, 1916. It would seem to be opportune that a *résumé* of the results of laboratory investigation and clinical observation should be presented at this time in order that an accurate statement may be made as to the value of the remedy.

Acidum phenylcinchoninicum, phenylcinchoninic acid, is an organic acid,—2—phenyl—quinoline—4—carboxylic acid, $C_{16}H_{11}O_2N$ or $C_6H_5.C_9H_5N.COOH = 249.10$.

Source.—By warming pyroracemic acid, benzaldehyde, and aniline in an alcoholic solution, followed by filtration and purification.

Characters.—Small colorless needles or a white or yellowish-white microcrystalline powder, odorless or having a slight odor resembling benzoic acid, and a bitter taste. It is permanent in the air.

Solubility.—Insoluble in cold water; slightly soluble in cold alcohol, hot water, or ether; soluble in alkalies and, upon heating, in acids; readily soluble in hot alcohol.

Dose.—0.5 gm. = 500 milligrams (8 grains).

Action of phenylcinchoninic acid.—This manifests itself largely upon the kidneys, chiefly stimulating their circulatory cells, generally increasing the flow of urine but not the amount of elimination of the purin bodies, sulphur, or phosphoric acid. It markedly augments the elimination of uric acid in man, in most instances even when upon a purin-free diet. This action is stronger and more promptly manifested than after the use of salicylic acid. Inasmuch as there is no increase in the number of leucocytes, which occurs after the exhibition of the latter remedy, this increase of uric acid elimination cannot be due to their destruction, and, further, this increase is noted not only when the individual is subsisting upon a mixed but equally as well when he is ingesting a purin-free diet. One observer, investigating its effect upon the endogenous uric acid excretion of healthy individuals, found that after a week of purin-free diet 30 grains of phenylcinchoninic acid administered for one day increased the uric acid excretion by more than 3

grains. During the period following the administration of the drug the amount of uric acid excretion was distinctly lessened. This observation has been confirmed by others, and as well for a mixed diet. It would appear that the principal result of the administration of phenylcinchoninic acid is to eliminate the uric acid of the blood by way of the kidneys, leaving the blood content subnormal. It has even been suggested that this remedy stimulates—possibly selectively—the secretion of uric acid, so constantly has this result been observed. By making use of the colorimetric (phosphotungstic acid test) for quantitatively determining the uric acid present in the blood, it has been found that as the uric acid diminishes in the blood under the influence of the drug there is simultaneously a marked increase in the uric acid contained in the urine, with an augmentation of the total amount of urine. This last statement, however, has been denied by others. The ammonia and total nitrogen in the urine may at times show a slight increase, but not at all in proportion to the marked increase of uric acid. The cloudiness of the urine which is observed during the first few hours after the administration of the remedy is due to the precipitated urates.

The action of phenylcinchoninic acid upon the kidneys would appear to be limited to that of transferring uric acid by means of these organs from the blood to the urine, and this action, both as to the increased elimination of uric acid and the usual augmented amount of urine excreted, terminates in about nine hours.

The principal experimental work upon phenylcinchoninic acid has been done by the following: 1908, Nicolaier and Dohon; 1911, Weintraub, Starkenstein, Frank and Bauch, Deutsch; 1912, Dohrn, Plehn, Bach and Strauss, Impens, Wiechowski, Skórczewski and Sohn, Fasiani; 1913, Retzloff, Haskins, Folin and Lyman, McLester, Kehrer, Rolph, Hahn; 1914, Daniels, Fine and Chace, Steinitz; 1915, Smith and Hawk.

Therapeutics of phenylcinchoninic acid.—It should always be administered in large quantities of water. In order to prevent the formation of uric acid calculi during its rapid elimination, it is well that sodium bicarbonate be administered—one-half ounce on the first day, and from one to two drachms on the succeeding days of treatment.

Gout.—In acute attacks it relieves pain and other symptoms more promptly than colchicum, but without disagreeable after-effects, such as cardiac weakness and diarrhea. In some instances it has given prompt results even when colchicum or massage combined with hydrotherapy had failed. In the chronic forms it is often of value, especially in cases in which arthritic, myalgic, and neuralgic pains are present.

Since it has no action upon deposited urates, it is not likely to diminish the size of gouty tophi, although some clinical observers have reported this diminution as well as lessened hardness. It is often advan-

tageous to intermit the administration of the remedy in order that the exhaustion of its action may not be encountered. Fifteen grains may be taken twice daily for three days, then one-half this quantity at the same interval for two days. After three days' interval, the series may be recommenced, for it has been shown that the initial concentration of the uric acid in the blood is again reached from three to four days.

If it can inhibit uric acid formation by limiting purin metabolism, as has been claimed, it might be employed as a prophylactic in gout, and for this purpose fifteen grains daily, continued over considerable periods of time should suffice. Although the relations between gout, purin bodies, and uric acid have never been thoroughly understood, the accepted hypotheses are at least workable.

The uric acid problem must be attacked either by increasing the solubility of the urates in the organism, which is the method hitherto mostly in vogue; or by intensifying the fermentative uric acid decomposition, which has been studied by Brugsch and Scheltenhelm but without practical results; or, lastly, by stimulating uric acid excretion, which is the result of the administration of phenylcinchoninic acid.

Acute Articular Rheumatism.—In this disease the results of its administration, forty-five grains within six hours, are sometimes favorable in relieving pain, but it is not so satisfactory as the salicylates, although it does not cause diaphoresis, at least not a marked one, anorexia, or gastric disturbances. In addition to the relief of pain, in some instances the temperature rapidly declines and reaches the normal in from three to four days.

Chronic articular rheumatism.—In the various forms of this condition, its action is variable and at best one must expect to obtain less benefit than in the acute forms. Inasmuch as these conditions are of such varied origins, one remedy cannot be expected to accomplish uniform results.

Sciatica.—It sometimes relieves pain, but is more likely to fail. This should be expected because the causes of sciatica are so dissimilar. It has been claimed by some observers that phenylcinchoninic acid possesses analgesic properties, and it has been employed for this reason.

Clinical reports have been published by many authors, notably by Arnung, Bach and Strauss, Bendix, Bolling, Brugsch, Crofton, Deutsch, Frank, Friedeberg, Green, Goldschmidt, Grasser, Georgiensky, Heller, Hirschberg, Jakl, Kahlo, Klemperer, Lichtwitz, Minkowski, Neukirch, Oeller, Richter, Rasin, Rickertz, Salus, Sawyer, Tschernikow and Mayat, von Mueller, Weintraub, Woodward, and Zuelzer, chiefly as to the results of its administration in gout, both acute and chronic, gouty pharyngitis, acute and chronic rheumatic polyarthritis, as well as in arthritis of various types, such as arthritis deformans. Isolated reports have ap-

peared upon its use in gonorrheal arthritis, sciatica, and other neuritic and neuralgic conditions, migraine, hemicrania, lumbago, certain forms of eczema, erythema nodosum, pruritus, iritis, episcleritis, iridocyclitis, otosclerosis, and more recently, following the vogue, in pyorrhea alveolaris.

The only untoward symptom reported following the use of this remedy, beyond a slight reduction in blood pressure, is, in one instance, a scarlatiniform eruption. The important contraindications to its employment are fatty heart, chronic alcoholism, and especially the existence of vesical or renal concretions.

We may safely conclude that phenylcinchoninic acid will doubly or even triply increase the elimination of uric acid in the urine, not because it increases its production in the body, for it does not, but because by its action, possibly selectively upon the kidney cells, it increases the permeability of the kidney for uric acid. When such an action is desired, and the instances are numerous, the remedy produces remarkable and uniformly constant results. Gout and gouty manifestations are invariably benefited; so-called rheumatism is frequently relieved—although this is merely empirical—and many other conditions of perturbed metabolism are improved. Beyond doubt, it is a valuable addition to our armamentarium.

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NEURO-CIRCULATORY MYASTHENIA

A Problem of the Substandard Soldier

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The efficiency of an army depends upon the ability and capability of the individual unit. It is therefore no small and no unimportant part of the duty of the Medical Corps of an army to determine at the earliest possible moment those who will make reliable soldiers and to separate from them, those who are constitutionally or otherwise inefficient.

The fact that the present field of battle is more than 3,000 miles distant, strongly emphasizes the importance of a service that will permit no useless recruit, if possible, to encumber transportation or to add to the burden of an already overcrowded hospital system. Then, too, though our country has a manifest right to take our life and property, if absolutely necessary and if of value, it would be evidence of supreme folly to deprive the State of a partly self-supporting civilian for a near-

soldier, who would break down at the first intense physical strain or shock of battle.

One of the first steps then in the development of a new army is to sort out those who are manifestly unfit. This group includes cases of pulmonary tuberculosis, organic diseases of heart and blood vessels, exophthalmic goitre, marked hypertrophy of the heart and persistent tachycardia.*

This sorting made with considerable rapidity on account of the need of speedy action suffices to weed out a considerable number whose inefficiency is detected by this superficial examination. The remainder return to their commands for the rapid and intensive training necessary to create real soldiers.

As this training becomes more and more intense, soldiers are reported by their regimental surgeons as not being able to keep up with their work and as complaining that the hard drilling causes breathlessness, precordial pain, headache, giddiness, early and prolonged exhaustion. The regimental surgeons on account of their multifarious other duties seem not to have the time needed to closely observe and record the actual condition of these men after their various exercises and drills—the true test of their efficiency as soldiers.

The difficulty of determining with accuracy and with justice the exact condition of these soldiers was such as to render routine examinations seem practically worthless. Permission was therefore kindly given by the Division Surgeon at Camp Sevier, S. C., Lt. Col. Whaley, M. C., to assemble these doubtful cardiac cases in a separate detachment on the grounds of the base hospital to which they were assigned for rations and quarters, but not carried as patients on the hospital roster.

A cardio-vascular detachment of ten tents was opened and forty-four soldiers received with their complete equipment, except arms, to remain under observation.

Of these forty-four cases, seven were found to be cases of organic diseases of the heart and were sent to the S. C. D. board for discharge. Five were adjudged free from any cardio-vascular disability and were returned to their commands with the request that they be kept under observation for a time. The remaining thirty-two soldiers all had this in common:—they were reported **as inefficient soldiers and yet no determinable organic cardio-vascular lesion was found.**

They presented practically the same symptom complex:—

Marked cyanosis of the hands extending up above the wrists.

Coldness and sweating of the hands and feet.

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* No mention need be made here of other causes of disability—neurologic, surgical, orthopaedic, etc.

Sweating under the armpits even when in a cold tent.

Tremor: Flushing.

Marked lability of the pulse and blood pressure on standing, lying down and after exercise.

Marked thrill often felt over the precordium.

No increase of cardiac dullness.

Booming first sound or indefinite murmur at the apex.

Frequent accentuation of the second pulmonic sound.

Mental instability.

After exercise these patients became more or less breathless and cyanotic and complained of precordial pain, palpitation, giddiness and abnormal exhaustion.

The type of their physique was first studied and determined according to Pignet's* formula (Vedder's Medical War Manual No. 1, page 70).

Pignet's formula for estimating Physical Efficiency. The weight in kilograms and the chest measure at expiration in centimeters are added and subtracted from the height in centimeters.

Index of efficiency:

Under 10	Very Strong.
10 to 15	Strong.
15 to 20	Good.
20 to 25	Fair.
25 to 30	Weak.
30 to 35	Very Weak.
Above 35	Useless.

These soldiers were grouped by Pignet's formula as:—

Useless	9
Very Weak	6
Weak	6
Fair	5
Good	2
Strong	1

Only one of these men could be graded as "strong." Half of them were "very weak" or "useless."

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*Pignet's formula is given apparently as of accepted value but without comment. Investigation reveals that it was evolved by Major Pignet, a contemporary French army surgeon. Dr. J. A. Blake, a British army surgeon, translated this formula into British measurements. Major Butza of the Roumanian army records the use of this test on 816 men in different regiments and considers it of incalculable value. It was in use in the garrison at Bucharest as a method for determining the physical constitution of the recruits and consequently their fitness for military service. He states this formula is an excellent one in the interest of the men themselves, for the army and for the nation.

Examinations by the nose and throat specialists and the dentist revealed apparent foci of infection in every case; many had double infections—both diseased tonsils and pus pockets about the teeth.

The examination of the blood in three cases—before, directly after and one hour after a two hours' hike gave the following findings:

Practically no difference in the number of leucocytes before and directly after exercise; an increase of from 50-90 per cent. in leucocytes in all three cases one hour after exercise. No material change determined in types of leucocytes. X-ray examinations of the gastro intestinal tract in four of these patients showed normal motility of stomach and small intestines. One of the four had a gastroptosis; the border of the stomach reach the pubis (erect posture). Examinations of the urine were not made and temperature, pulse and respirations morning and night were not taken due to incomplete organization.

A summary of the findings in each case is herewith given:

Name	Neuro-vascular condition	Efficiency per Pignet's formula	Nose and throat condition	Dental condition	Other conditions
Case 1 C. B.	Precordial pain; breathless exhaustion; giddiness; palpitation; cold hands and feet; cyanosis; sweating; mental instability.	28 Weak	Diverted septum 1. Hypertrophied mid. turbinate Tonsils enlarged and pus in pocket.	Severe gingivitis, numerous pus pockets.	No Hook-worm
Case 2 M. J. G.	Breathlessness, anginal pain, hyperalgesia, exhaustion, palpitation, giddiness, headache, lassitude, coldness and sweating of hands and feet, irribility.	46.50 Very weak	Tonsils submerged and enlarged, crypts with chessy material possible foci.	No foci of infection.	No Hook-worm
Case 3 L. G.	Breathlessness, exhaustion, giddiness, fainting, palpitation, headache, lassitude, cyanosis, cold H. & F., sweating, flushing, mental instability, tremors.	27.50 Weak	Negative	Two foci of infection. Slight gingivitis.	No Hook-worm
Case 4	Breathlessness, hyperalesia, giddiness, palpitation, headache, sweating.	35 Useless	Rt. ethmoid suspicious, middle turbinate unhealthy and discharging.	Gingivitis with pus pockets around several teeth.	No Hook-worm
Case 5 B. G. O.	Breathlessness, precordial pain, exhaustion, giddiness, fainting palpitation, headache, coldness and sweating of h & f, cyanosis, flushing, mental instability.	37.15 Useless	Left tonsil diseased and possible focus, adenoids present.	Negative	No Hook-worm
Case 6 W. B. L.	Breathlessness, precordial pain, hyperalgesia, giddiness, palpitation, headache, lassitude, coldness and sweating of h & f, cyanosis, mental instability.	31.76 Very weak	Bad tonsils. Should be removed. Adenoids.	Focal infection suspected. Sent for x-ray exam.	No Hook-worm
Case 7 J. O. P.	Cough, breathlessness precord. pain, giddiness, palpitation, fainting lassitude, coldness of h & f, sweating of h, cyanosis mental instability.	27.90 Weak	Crypts of tonsils show cheesy material. Possible foci.	Slight gingivitis. No other foci of infection.	No Hook-worm

Name	Neuro-vascular condition	Efficiency per Pignet's formula	Nose and throat condition	Dental condition	Other conditions
Case 8 C. F. G.	Breathlessness, precord. distress, exhaustion, giddiness, fainting palpitation, sl. coldness and sweating of h & f, sl. cyanosis, sleeplessness, inability to fix attention, sl. tremor.	24.4 Fair	Nose and sinuses clear. Tonsils sm. Small amount of cheesy from a few follicles.	One tooth is a focus of infection.	No Hook-worm
Case 9 A. M. B.	Breathlessness, precordial distress, exhaustion, giddiness, fainting, headache, sleeplessness.	26.50 Weak	Questionable ant. Bilat. ethmoid Inf.; fair sized adenoids. Tonsils much enlarged.	Mouth in bad condition. Gingival pus pockets present, several sus. blind abscesses.	No Hook-worm
Case 10 G. F. E.	Breathlessness, exhaustion, giddiness, headache, palpitation, coldness and sweating of h & f, marked cyanosis, marked tremor and flushing.	38.50 Useless	Nose and throat clear. Cheesy material in both tonsils, possible foci of infection.	Negative. Not caring for teeth.	No Hook-worm
Case 11 H. H.	Marked breathlessness, precordial distress, exhaustion, fainting occasional, headache, coldness and sweating of h & f, cyanosis, sleeplessness, slight tremor, hyperalgesia.	21.50 Fair	Nose and sinuses clear. Crypts of tonsils cheesy, possible foci of infection.	Two teeth need attention. No focal or blind abscesses	No Hook-worm
Case 12 A. L.	Breathlessness, precordial distress, exhaustion, giddiness, palpitation, headache, lassitude, coldness and sweating of h & f, irritability, restless at times, flushing.	21.50 Fair	Sinuses clear; adenoids large; tonsils very lg. and badly infected.	Negative	No hook worm. X-ray gives impression not only of a healed tubercular condition but some present activity.
Case 13 O. K.	Breathlessness, marked; giddiness, palpitation, coldness and cyanosis of h & f, irritable.	31.38 Very weak	Sinuses clear; cheesy material expressed from tonsils. Pos. foci of infection.	Negative	No Hook-worm

Case 14 O. C.	Breathlessness, precordial pain, hyperalgesia, exhaustion, giddiness, palpitation, headache lassitude, coldness and sweating of h & f, cyanosis, sleeplessness, tremor, slight flushing.	12 Strong	Nose and sinuses clear. Tonsils definitely diseased. Probable foci.	Gingivitis with a few pus pockets. Two teeth suspected as having blind abscesses at roots.	Hook-worm
Case 15 J. S. G.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, headache, coldness and sweating of h & f cyanosis, irritable.	34.74 Very weak	Dev. nasal septum blocking ven. and Drg of sinuses. Ton. small cheesy material in crypts.	Suspected blind abscesses. Gingival pockets about all teeth, possible foci.	No Hook-worm
Case 16 T. S.	Breathlessness Plus.; precordial distress, exhaustion, giddiness, lassitude, coldness and sweating of h & f, cyanosis.	45.60 Useless	Sinuses clear. Ton. lg. badly diseased. Probable foci of infection.	Negative	No Hook-worm
Case 17 J. C. S.	Breathlessness, precordial pain, hyperalgesia, exhaustion, giddiness, palpitation, headache, lassitude, coldness and sweating of h & f, cyanosis, sleeplessness, inability to fix attention, marked tremor.	44.46 Useless	Deviated septum r. Sinuses clear. Cheesy material expressed from tonsils.	Several suspected blind abscesses. Gingivitis with marked pus pockets.	No Hook-worm
Case 18 C. M.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, lassitude, coldness and sweating of h & f, sl. cyanosis, sleeplessness, inability to fix attention.	29.74 Weak	Small amount of cheesy material expressed from tonsils.	Probably several blind abscesses.	No Hook-worm
Case 19 S. P. M.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, lassitude, coldness and sweating of h & f, sl. cyanosis, sleeplessness, inability to fix attention.	36.9 Useless	Nose and sinuses clear. Tonsils small and fibrous. Negative.	Negative. Slight gingivitis with some pus.	No Hook-worm

Name	Neuro-vascular condition	Efficiency per Pignet's formula	Nose and throat condition	Dental condition	Other conditions
Case 20 C. E.	Breathlessness, exhaustion, giddiness, mid-sternal pain, palpitation, headache, lassitude, coldness and sweating of h & f, irritability, restless, tremor, slight cyanosis.	19.10 Good	Ch. athmoiditis. Bilat. atrophic rhinitis.	Severe gingivitis, some pus pockets. No blind abscesses.	No Hook-worm
Case 21 C. L.	Breathlessness, precordial distress, exhaustion, giddiness, lassitude, irritable, sleeplessness.	30.76 Very weak	Ac. rhinitis, cheesy material in tonsils. Possible foci infection.	Some gingival pus pockets. Blind abscesses on two teeth.	No Hook-worm
Case 22 H. L.	Breathlessness, precordial distress, exhaustion, palpitation, lassitude, coldness and sweating of h & f, cyanosis, slight tremor.	20 Fair	Nose and sinuses clear. Some cheesy material expressed from tonsils. Possible foci of infection.	Several pus pockets. Severe gingivitis and probable pyorrhea.	No Hook-worm
Case 23 J. S. S.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, headache, lassitude, coldness and sweating of h & f, cyanosis, sleeplessness, inability to fix attention.	17.15 Good	Nose and sinuses clear. Tonsils seem badly diseased.	Bad mouth; pus pockets about all teeth. Blind abscesses on two molars.	Hook-worm
Case 24 J. H.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, headache, lassitude, coldness and sweating of h & f & body, cyanosis, mental instability, tremor.	35.12 Useless	Nose and sinuses clear. Deviated septum, tonsils small out infected, probable foci.	Slight gingivitis. No visible pockets. Two teeth suspected of blind abscesses.	Hook-worm
Case 25 W. E. T.	Breathlessness, precordial pain, exhaustion, giddiness, fainting, palpitation, headache, lassitude, sweating and coldness of h & f & body, cyanosis, mental instability, sl. tremor.	29.39 Weak	Post. group sinusitis bilat. Ant. ethmoid left. Tonsils definitely diseased.	Death of two teeth from old trauma. Prob. antrum trouble right side.	Hook-worm

Case 26 G. E. F.	Breathlessness, precordial pain, exhaustion, giddiness, palpitation, lassitude, coldness and sweating of h & f & body, mod. cyanosis, irritability, sl. tremor.	38.92 Useless	Nose and sinuses clear. Tonsils enlarged and infection prob. foci.	Some carious teeth. Other teeth in good condition. Except two lower incisors.	No Hook-worm
Case 27 S. T.	Breathlessness, precordial pain, exhaustion, giddiness on exercise, fainting, palpitation, headache, lassitude, coldness and sweating of h & f & body, cyanosis, mental instability, sl. tremor.	20.78 Fair	Nose and sinuses clear. Tonsils definitely diseased, probable foci of infection.	Teeth in front contains old root under bridge, two pockets due to gingivitis.	
Case 28 G. S.	Breathlessness, anginal pain, exhaustion, giddiness, faints easily, palpitation, lassitude, sweating and swelling of feet, cyanosis, mental instability, slight tremor.	30.75 Very weak	Nose and sinuses clear. Crypts of both tonsils filled with a cheesy material, pos. foci.	Negative	No Hook-worm
Case 29 C. R. M.	Breathlessness after severe exercise, precordial pain on exercise, exhaustion, sl. very sl. tremor. Dislike to alcohol.	32.79 Very Weak	Nose and sinuses clear. Several follicles in ea. ton. filled with a cheesy mat. Pos. foci.	Slight gingival Inf. questionable foci of inf. 2 teeth suspected.	No Hook-worm

At first the diagnosis and disposition of these cases caused the greatest uncertainty. It was quickly realized that they were manifestly not fit* for military service, but how to classify them without arousing suspicion about one's own diagnostic acumen, without endangering the efficiency of the army and without doing injustice to the soldier himself was the question. Mitral stenosis, Tachycardia, Goitre heart kept constantly recurring, but with a feeling of question and doubt.

Finally the realization suddenly became manifest that all these soldiers were a group of substandard men who had been subjected for many years to a low grade infection and were suddenly thrown into a new environment with conditions of life entirely different from all their previous experiences.

The diagnosis was then no longer in doubt:—

The listless, dull expression; the relaxed, careless posture and carriage; the tremor; the marked cyanosis of the hands reaching half way to the elbows; the coldness and moisture of the palms of the hands and the profuse perspiration of the armpits even in a cold tent made a picture which, when appreciated, is recognized often at the first glance.

The British in their vital haste to send immediate re-enforcements to the French army accepted, practically without examination, every volunteer who could walk. Soon the result of such an unfortunate though necessary policy became apparent. The British hospitals were soon hopelessly submerged by soldiers with irritable hearts who seemed to be made worse under the usual hospital treatment and thus likely to become chronic invalids and occupy beds urgently needed for the serious cases.*

Thomas Lewis and his associates, among whom are several members of the M. R. C., U. S. Army, promptly established order out of this chaos and placed the treatment of these cases upon a basis which not only rendered the diagnosis certain, but also definitely determined the prognosis and absolutely established the correct method of treatment, i. e., progressively graduated, efficient exercise.

The British problem had to do with soldiers returned disabled from the front, one-half of whom were regarded as constitutionally unfit, while the other half were the result of extreme exhaustion, shock or infection. The British cases are divided etiologically into three groups.

A.	Constitutional	50 per cent.
B.	Exhaustive	50 per cent.
C.	Toxic	

Our present problem is somewhat different from that of the British as we have the time, the men and the opportunity without interfering

*Many of these soldiers were refused discharge by the S. C. D. Board as no determinable lesion was found.

with the rapid training of the fit. Briefly, it is to prevent the sending to the fighting line of the 50 per cent. who, because they are constitutionally defective, will promptly break down under the intense strain of modern warfare and thus become an incalculable burden to the army rather than of any military value. The determination of this constitutionally, sub-standard 50 per cent. should not in the great majority of cases be a matter of difficulty. This does not require complicated apparatus nor intricate methods. It resolves itself simply into determining under close observation **what men cannot do efficiently the work of a soldier.**

This type of case plays no part in civil practice because these patients seek the line of least resistance and only undertake the work they are physically able to do. They are often classed among the shiftless, the ne'er-do-wells, the constantly complaining, without pep, energy or ambition.

DaCosta with keenness of the great internist recognized in the Civil War and described accurately under the term "Irritable Heart of Soldiers," this same condition, and prescribed a system of graduated military work which in essentials is similar to that now advised by the British. Lewis, in order to avoid the psychic effect of fear of heart disease upon these men, gave the name "Effort Syndrome," which tells nothing except that it is the result of effort and then only in a very small percentage of the soldiers subjected to excessive effort. The American Physicians working with Lewis, recognizing its nervous and circulatory manifestations and its kinship to neurasthenia, have called it "neuro-circulatory asthenia." This term, which is very expressive, lacks, however, a description of one of the most striking characteristics of this disorder, viz: the marked weakness of the muscular system, both the myocardium and the voluntary muscles. This omission is corrected by the use of Myasthenia instead of asthenia, thus placing this disability upon the triadweakness of the nervous, circulatory and muscular systems.

In the cases under our observation the object was not only to recognize this condition, but also to initiate measures which might result in gradually building up a condition of first-line efficiency in some of those who had been found to be unfit, to render others valuable for special military service, and to return the balance to their former occupations in civil life.

These soldiers were therefore sent to the clinics at the base hospital for the treatment of their teeth and tonsils and graduated exercises were given twice a day with graded hikes in the afternoon. An effort was made in the exercises to follow out the advice of Lewis, based upon the British experiences. They were taken from the manual and arranged by Capt. J. D. Thomas, M. R. C., and were carried out with soldierly

precision under the direction of an intelligent and enthusiastic drill sergeant. During the exercises the soldiers were closely watched by two physicians in order to detect at once evidence of abnormal exhaustion. These simple exercises, readily applicable, seemed more accurate than any complicated system, as each soldier had in them the correct measure of his own efficiency, i. e., his own weight. The problem is what each soldier can do with his own physique, irrespective of height and weight. This limited and superficial try-out, so easily inaugurated, would seem to indicate that much of profit and scientific value might be secured if it could be extended and made more complete. These soldiers, part well, part ill, are not proper hospital cases, but should be kept under rigid military observation in field hospital tents or in barracks. The temperature, pulse and respiration should be taken twice a day, with conveniences for blood and urinary examinations, and they should be placed accessible to a base hospital where treatments for foci of infection could be carried out and X-ray pictures taken as seemed indicated.

A well-balanced and graduated series of exercises and hikes under especially trained and enthusiastic drill sergeants, followed later by the gradual resumption of the regular work of the soldier, could be initiated and the exact results noted from day to day in order to determine the wisdom and extent of further progress. Baseball, football, basketball, sparring and wrestling, together with appropriate occupation, as gardening, knitting and basket weaving, should be encouraged in this type of case, as there is a marked tendency to mental depression and introspection with a lack of initiative.

Such reconstructive work would save for the army many soldiers who, under the stress of warfare, would quickly break down and would become a serious burden on our hospital service for long periods; others not so strong could be held in the army for special service and the remainder totally unfit for military duty could be returned to their former occupations in civil life—all better and wiser men for their experiences in the army.

SOME POINTS IN THE MANAGEMENT OF DISEASES OF THE HEART

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Looking back on his own experience and the practice of others as it came to his notice, the writer gets the impression that failure properly to prescribe rest is a mistake in cardiac therapeutics which happens

frequently and therefore he will begin these brief remarks on the management of diseases of the heart with a few words on the use of rest in those diseases.

The first principle in the use of rest in heart diseases is to give it in a sufficient dose, and if a mistake is to be made to make it on the safe side by giving too much rather than too little; for giving too much rest rarely does harm to a cardiopath, while failure to give enough may imperil his chance of recovery or improvement; of all remedies the bed is the least harmful in overdose.

The full dose of rest means the horizontal position—feet in bed and head on pillow; and revolution of the body permitted only on its horizontal axis; and no debate on the bedpan question; and the sitting position allowed only when there is orthopnea.

Just how long a patient should remain in bed after compensation for the horizontal position has been apparently restored is not always easy to decide. In chronic valvular disease of inflammatory origin, occurring in adults, the writer's rule is to keep the patient in bed for at least one month after such apparent recovery. In the case of children, his rule is to keep the patient in bed indefinitely, that is, to refuse to set a definite time for getting up. It usually happens that if no such date is set, the patient will be kept in bed about long enough, for the parents usually will connive at disobedience of orders when the child has appeared well for a considerable time. Keeping a child in bed for a long time does him no harm, and it safeguards him to a considerable extent from recurrences of his original disease and starts him in training for the disciplined and restricted life which may be his lot.

In acute endocarditis absolute rest in bed should be maintained for at least three months after symptoms of the acute disease have passed away, whether or not signs of cardiac insufficiency were present.

In acute myocarditis and acute myocardial degeneration the length of time to which the rest in bed need be prolonged depends on the pathological changes in the heart, which changes cannot be accurately made out; but in any case in which pronounced signs or symptoms of myocardial degeneration were noted, the period of rest should be measured in months. In the mild cases which occur regularly in typhoid fever and give no pronounced symptoms, confinement in bed for at least two weeks after defervescence is usually sufficient; but in those cases of typhoid which show unduly rapid pulse, or in which a transient mitral regurgitant murmur is observed, the rest in bed should be continued several weeks longer, and the getting up made gradually and cautiously, and a close watch kept on the behaviour of the heart during the process; if the pulse shows an excessive increase of rate on getting up, the patient should be put back to bed and kept there for several weeks before trying it again.

In cases in which there has occurred a sudden dilatation of the heart it may be necessary to keep the patient in bed for many months. The writer has seen persistence for months and even years of irritability and weakness of the myocardium, manifested by tachycardia and shortness of breath on slight exertion, which seemed to be referable to undue haste in getting out of bed after an apparently moderate typhoid.

In diphtheritic myocarditis prolonged rest is highly necessary and even if no special signs of cardiac involvement have been noted the heart should be safeguarded by at least several weeks' absolute rest in bed after apparently complete recovery; and if such signs have been observed, three months' stay in bed may be considered the minimum requirement, with special restriction of activity for a subsequent period of not less than a year.

The simple pneumonic heart, without direct inflammatory involvement, presents an imperative indication for absolute rest, although as a rule, for a short period only; in uncomplicated cases the patient can usually be allowed out of bed by the twelfth day after defervescence. During the active period of the disease the patient should be watched constantly or, if that is not practicable, should be restrained, so as to prevent his sitting up or getting out of bed in delirium. A valuable prophylactic in the management of the heart in pneumonia, which the writer has brought out in previous publications, and one which he takes the present occasion to refer to again, is constipation: the use of cathartics is avoided almost entirely. This prophylactic constipation is made possible first, by a special diet, limited in quantity, which discourages with an unfavorable culture medium the growth of the swallowed pneumococci and the putrefactive bacteria in the alimentary canal; and, second, by avoidance of medication capable of disturbing that canal.

In uncomplicated influenza absolute rest in bed from the beginning of the disease until three days after disappearance of the last symptom referable to the influenza, should be the rule. Observance of this simple rule is the best safeguard against the cardiac and other complications of influenza, especially in the aged. As a corollary to this rule might be added extreme conservatism in the use of the coal-tar derivatives, abuse of which is so common.

In conditions of chronic myocardial degeneration with cardiac insufficiency, particularly in the aged, it may be advisable to modify the indicated dosage of rest in order to meet the requirement of keeping the remaining sound fibers of heart muscle in good working order by exercise. It is a common teaching that old people with weak hearts should not be kept in bed for long periods if it can be avoided. This teaching has a certain amount of force, but it should not be made too much of; and when the question of keeping in bed an aged patient with

chronic myocardial degeneration comes up for decision, the danger of hastening a cardiac downfall by permitting too much activity should be very carefully weighed against the danger of weakening the heart by too much rest; and it is usually safest to allow the former the preponderating influence. Certainly one or two weeks in bed to enable a therapeutic test of myocardial efficiency to be made by noting the amount of recovery of function, is a safe enough procedure. The possible bad consequences of prolonged rest in bed can be counteracted to a certain extent by massage, passive motions, and resistance exercises.

The restrictions of activity required in cases with fragile compensation or diminished myocardial reserve power play an important part in the management of heart diseases, but their discussion will be passed over with a reference to the general rule, that in all such cases the patient should keep his activities well within the limits of safety, and not try to find out by experimentation just how far he can go. The writer is in the habit of saying to these patients: The better you feel the more careful you must be, for when you feel badly you will be careful anyway, but when you feel well it is natural to be more careless.

The department of cardiac therapeutics which has to do with modification of the diet to meet cardiopathic requirements is one of obvious and great importance. In all cases of cardiac insufficiency more or less passive congestion with its disturbances of tissue metabolism is present, and this constitutes a requirement that the food be easy of digestion and also that it be of a character to safeguard as much as possible the subnormally resistant tissues from injury by toxemias of dietetic origin. Animal flesh and its derivatives, and eggs are common sources of these toxemias, and their exclusion or restriction is therefore indicated in the cardiopathic diet. Milk, however, in some form or other, is generally admissible, and thus the requirement that a considerable proportion of the protein ration be animal protein can be satisfactorily met. Milk possesses all the nutritional advantages of flesh with some others, and is free from most of the disadvantages of the latter. Milk is pre-eminently an easy food, both as regards its protein and otherwise. In this connection it is interesting to note that milk is the specially prepared food which the mammals provide for their young during the immature period following birth. It differs from all other varieties of animal food which contain protein in that it sours when it spoils, thus insuring for its protein a certain amount of protection from putrefaction; the other varieties of animal food containing protein, viz., flesh and eggs, putrefy when they spoil. Herein appears an argument supplied by nature for milk as the ideal source of animal protein in the *easy diet*, and a confirmation of the clinical fact that a diet which favors the growth of the acidophilic bacteria in the

alimentary canal is easier on the organism than one which favors the growth of the bacteria of putrefaction. Nature knew what she was about when she made this easy food for the young of the mammals in their weak and immature period, and we can with advantage apply her teaching to the construction of an easy diet for adults who are weakened by disease or age.

In advanced conditions of cardiac insufficiency, with notable crippling of the digestive apparatus or extensive congestion of the liver or kidneys, a temporary reduction of the diet to thin cereal gruels, modified milk and fruit juices may be required; and when much edema is present limitation of the fluid intake is a reasonable procedure; but the dry diet need not be carried to such extremes that the daily fluid intake is reduced to less than thirty or forty ounces. The "Karrel diet" owes part of its success to its non-putrefactive character as well as to its reduction in quantity.

In acute inflammations of the heart, especially in the young, which usually occur secondarily, the primary condition as well as the cardiac complications call for a very easy diet; but after convalescence has been established, it is generally advisable to feed up the patient so as to secure as rapid a restoration to health of the cardiac tissues as possible; but a liberal diet does not necessarily mean one containing large quantities of animal flesh, although a moderate amount of animal flesh is desirable in order to tempt the appetite, stimulate digestion, and exercise and develop the protective mechanism. The diet in these cases should include an abundance of milk and its products, a small amount of animal flesh and eggs, and a wide range of selected fruits, vegetables, and cereal foods.

In the chronic myocardial degenerations, which are usually accompanied by other degenerative conditions calling for dietetic regulation, the indicated diet is a lactovegetarian one or approximately such. In the less advanced cases, particularly in patients who possess a superior tolerance for the protein poisons in question, a small amount of animal flesh or eggs two or three times a week is usually allowable; but the general proposition holds. In all cases of myocardial degeneration the number of meals should be increased and their size made small, and the evening meal should be a light one.

In the treatment of what is commonly known as cardiovascular disease regulation of the diet is the most important thing; and it is one of the greater satisfaction of the practice of medicine to watch the improvement in patients with this disease which so often follows the taking of a suitable diet. In the early high tension cases dietetic regulation alone may bring about a restoration of the blood pressure very nearly to the normal; and in the more advanced ones it usually brings at least

temporary improvement. Lowering of high blood pressure, persistent elevation of which is regularly compensatory, can be brought about most advantageously by diet, and the reduction thus obtained is salutary and does not interfere with vital circulatory necessities; and also, to a certain degree it indicates the extent of the pathological changes which called for the high pressure.

In the prophylaxis of cardiovascular disease the value of dietetic regulations along the lines above suggested cannot be too much emphasized. It is reasonable to expect that in the medicine of the future, which will be largely preventive, this phase of prophylaxis will receive a wider recognition than it now enjoys. Hitherto preventive medicine has been occupied chiefly with safeguarding against invasion of the body tissues by pathogenic organisms belonging to low forms of life; but the safeguarding of the body from unnecessary wear and tear in the processes of nutrition is likewise of fundamental importance.

In any diet due regard must be given to the saline elements of the food. This phase of the subject may acquire special importance if for any reason the diet for a considerable period has to be much restricted in quantity or variety. When abundant milk, fruit and vegetables are taken the necessary salts are usually provided; but when the diet is scanty or lacking in variety it may be necessary to add directly some of these salts, particularly those required to maintain the alkaline reserves in the body. It seems to be a necessary condition of the life of the tissues of the human body that they be continually bathed in an alkaline fluid, and this condition would seem to hark back to the time when man's remotest unicellular ancestor began life in the ocean: the body fluids are still maintained as solutions not very dissimilar to sea water. The salts of sodium and calcium are particularly important, and they should be directly added to the diet whenever there is doubt that enough of them is being supplied by the natural articles of food taken, or when insufficiency of the carbohydrate ration invites acidosis. The question of vitamines need cause no anxiety if plenty of milk, fruit, and vegetables are taken.

Mechanical forms of treatment, particularly formal exercises, massage, and baths, have been made much of in cardiac therapeutics. Passive motions, resistance exercises, and massage may be particularly useful in the period between recovery of compensation for the horizontal position in bed and the acquisition of sufficient reserve power by the heart to make it safe for the patient to get out of bed. But the exercises should be carefully controlled so that the educational and developmental effects on the heart muscle are produced without overstrain.

The therapeutic baths of most renown are probably those which for more than a generation have been exploited at Nauheim. No doubt

the war has seriously impaired their popularity, but it would seem that they have been much overrated; and James Mackenzie is on record as saying that their reputation is out of proportion to their merits.

In connection with the subject of therapeutic baths it may be proper to allude to the dangers of cold baths to patients with organic heart disease who are not habituated to their use, and especially the dangers to such patients of bathing in the sea or swimming.

In the management of diseases of the heart the question of when and how to use heart stimulant drugs comes up sooner or later, because the diseased heart is always either functionally insufficient or liable to become so. The scope of this paper does not permit detailed discussion of those drugs, but a few general remarks may be allowed.

The general rule for using heart stimulant drugs is to use them only when rest alone cannot restore the balance of the circulation; but there are exceptions, viz., they may be used to forestall decompensation which seems imminent; and they may be used without delay in cases which are obviously too bad to be restored by rest alone.

The general rule about their dosage is to use enough to produce the desired effect, but not to keep up an excessive dosage after that effect is obtained; and the corollary to this rule is to watch out for toxic effects and not to try to get improvement faster than nature is able to bring it about. Ability to use heart stimulants without abusing them is one of the marks of an expert therapeutist.

Of the direct heart stimulants included in the pharmacopoeia two stand pre-eminent, and their action as observed clinically is so like that they can be used to a large extent interchangeably. One of them, digitalis, is universally known and appreciated; the other, strophanthus, is not quite so well known. The writer has studied the effects of strophanthus clinically for many years, and has published his views on its use, and has made this inference from his observations, that to get the best results with it the doses given should be considerably smaller than those recommended in most of the text-books. Strophanthus has the advantage of possessing in its active principle strophanthin, the most uniformly reliable and the most powerful and quickly acting agent of the digitalis class. In regard to the administration of strophanthin, the writer would like to say a word. The intravenous method of administration has been especially commended, and justly; and the hypodermic method has been objected to by some influential writers because of severe pain caused by the injections. The present writer wishes to say in favor of the more convenient hypodermic method, that his observations do not confirm altogether the statements regarding the severe pain caused by the injections. In some of his cases severe pain was complained of, and in some others considerable local irritation was noticed;

but in many cases no complaint was made, or at least did not reach the writer. Of course the injection should be given deeply, and the solution made as dilute as the size of the hypodermic syringe permits. The sublingual method of administering strophanthin has also been found by the writer a convenient and effective one.

In connection with these two pre-eminent heart stimulants there are three other drugs which deserve special mention, viz., strychnine, caffeine, and morphine. These three drugs may not act as direct stimulants to the cardiac muscle as do digitalis and strophanthus, but they can be very efficient helpers in improving the circulation, and particularly morphine. Our appreciation of morphine in the treatment of the severer forms of cardiac insufficiency increases with our growth in clinical experience.

In concluding these brief, but it is hoped suggestive, remarks on the management of diseases of the heart, the writer would like to refer again for special emphasis, to that fundamental and universal remedy in diseases of the heart, rest. This remedy is so simple, so safe, and so easily applied, and the indications for it are so obvious, that one might think comment on it supererogatory; but the writer's impression that it is not sufficiently used is so strong, that he offers no apology for bringing it up for discussion.

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THE PLACE OF IPECACUANHA IN THE TREATMENT OF AURICULAR DISEASES

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New York.

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One of the most unique circumstances of the treatment of cardiac conditions is that nearly all practical measures are founded upon clinical observation rather than upon what might be inferred from experiment in the physiological laboratory.

The question is, how does a diseased heart react to a particular remedy? It is well known that digitalis reacts in an entirely unique way in the presence of disturbance of the function of tonicity of the heart muscle, and in the presence of a disturbed physiology of the auricle.

A discovery that is founded upon laboratory observation can be immediately accepted by the medical profession and applied without any discussion or debate. A discovery founded upon clinical inference must always be a matter for speculation and question by many observers and holds its place only by very insecure tenure. Later on the laboratory may discover the basis for the remedy, and then it takes its place in established practice. In this way ipecacuanha has been used for many years in the treatment of dysentery, while only of late has the discovery of the ameba put it upon a definite basis.

There is hardly a drug more frequently prescribed than ipecacuanha, though physicians are not really conscious of how often they use it. It forms an essential ingredient of the rhubarb, ipecacuanha, and soda combination that is the standard remedy for all undefined functional stomach disorders in the clinics of New York City. It is used in the form of Dover's powders, because physicians know that this is a remedy that gives relief under varying circumstances.

In the treatment of cardiac conditions ipecacuanha has naturally been used as an adjunct in this way and it has also been used by many as an emetic with the idea of terminating attacks of palpitation. Of course, the belief has been that the effect upon the auricular functional disorders was purely reflex.

The clinical observations which I wish to submit to this society and to the profession and for therapeutic experiment is that in disorders of the auricle, which I believe are very often of toxic origin, ipecacuanha seems to be a valuable adjunct to digitalis. It is the experience of every heart specialist that he is called to very seriously ill people who are suffering from fibrillation of the auricle. These persons are critically ill and have not had proper treatment. There is often not much time to spare and a remedy must be pushed to a degree that is, to say the least, bold. Where the circumstances were very desperate indeed and the medical attendance very inadequate, I have often felt obliged to order digitalis given until vomiting has actually been produced. On one occasion where I was afraid that when the vomiting of digitalis came it might do harm, I combined some ipecacuanha with my digitalis so as to increase the nauseating quality of the prescription in case the digitalis nausea should be postponed too long. To my surprise this condition responded more than usually well to the treatment and I was led to do the same thing on other occasions. One general practitioner was so impressed with the result that he told me afterwards that he had used the mixture of ipecacuanha and digitalis with surprising effect in a very serious emergency.

I am too much of a therapeutic critic to do more than suggest that others repeat the observation. Nevertheless, I have lately been com-

bining ipecacuanha with digitalis in those conditions which I believe to be due to toxic influences, acting upon the auricle. I have been using a tablet containing powdered digitalis, ½ grain, and powdered ipecacuanha, ⅛ grain. My expectation that nausea would be hastened has not been realized, but the effect of the digitalis seems to me to be improved.

In a person with an untreated fibrillation, the pulse being very rapid and irregular, I ordered:

℞ Pulv. digipuratum, gr. xviii
Pulv. ipecacuanha, gr. v
M. Fiant. pulv. No. xii

Sig.: One every four hours until four are taken; one every six hours until four are taken; and one every eight hours until four are taken.

That there is a definite effect from ipecacuanha on the heart and blood vessels has been recognized by authorities on therapeutics. In Bastedo's work on "Materia Medica and Pharmacology" (1918, page 565), under the heading of effect on the circulation, we find:

"There is a weakening of the heart muscle with slowing and dilatation similar to that from chloroform and not influenced by atropine or cutting the vagi. Death may result from auricular and ventricular fibrillation. In the frog or turtle heartblock has been observed. From therapeutic doses there is a very short and slight rise in arterial pressure, followed by a sharp fall and a general return to its former level. From toxic doses there is a progressive weakening and slowing of the heart and a fall in pressure with collapse. Pellini and Wallace obtained no change or a slight contraction of the arteries; but Evans, Middleton, and Smith say there is a transient vasoconstriction followed by a definite vasodilatation."

We all agree that ipecacuanha is a drug with active physiological and therapeutic qualities. It has definite relations to the functions of the blood-vessels. In large doses it is capable of doing much harm. In this it is like all our valuable drugs. It has certain analogies to digitalis which suggest it as an adjuvant. As to the value of my observation of its therapeutic value in this instance that must be confirmed by clinical observation much wider than one man can obtain.

ON THE DIFFERENTIATION OF AURICULAR FIBRILLATION AND ITS TREATMENT

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New York

While much has been written about auricular affections of late years, there are many matters relating to them which are still obscure.

For example, physiologists do not know as yet to what extent the impulse causing a heart beat is myogenic or neurogenic.

However, ordinarily the impulse takes its origin in the S-A, i. e., sino-auricular, or so-called upper node in the right auricle. But the influence extends itself secondarily to the A-V, i. e., auriculo-ventricular or inferior node of the same auricle. Passing onward, it reaches, first the left auricle and then the right ventricle through the muscle bundle of His. Eventually it is spread over the network of Purkinje which covers the lining wall of both ventricles.

But this influence may also originate in the coronary sinus which opens into the right auricle. There are also numerous other points from which the impulse may emanate that contracts auricles and ventricles.

In fact, if the upper node gets to be out of commission, another of its fellows will supplant it in function, one acting vicariously for the other. We also know that if the normal rate, which in the adult is apt to be set at 72 to 76, is interrupted by a loss of conductive energy in the bundle of His, some point in the ventricle may of itself start the impulse which then will develop a rate round about 30, or somewhere about half the normal.

Usually, when the impulse has started from the right auricle, contraction takes place, first in the conus or infundibulum, or in the anterior papillary muscle lying beneath the conus. The remainder of the right ventricle is then activated, except that part of the conus immediately beneath the pulmonary valve. For this part is the last to feel the impulse. On the other hand, in the left ventricle, the first portion to be excited is the apex, then neighboring parts, and finally the base.

Now a ventricle will only contract in response to a certain number of impulses during a given period. It requires a rest after each contraction, and it takes it. This interval of rest is called the "refractory stage" and the length of this period with relation to other refractory periods, helps us, by the assistance of the electro-cardiograph (or polygraph in some instances) to differentiate certain forms of cardiac arrhythmias.

Of these, I have made the following classification:

1. Sinus or vagus arrhythmias.
2. Extra-systolic arrhythmias.
3. Heart block.

4. Adams-Stokes disease.
5. Auricular fibrillation with its subvarieties, Flutter and Flicker.
6. Ventricular fibrillation.
7. Pulsus Alternans.

Now, all of these arrhythmias represent distinct complexes which can be differentiated either by ordinary clinical methods or by the electrocardiograph or polygraphic instruments. As a matter of fact, nearly every one of these divisions as here given can be determined at times without the two instrumental agencies mentioned. This is a very important matter, because one usually needs in such cases only the finger and a watch, for the mechanical part of the diagnosis.

But arrhythmias act usually in combination. For example, in Heart block and in Adams-Stokes disease, Pulsus alternans and Ventricular fibrillation, there may be Extra systoles. Again, Auricular flutter may pass to Auricular fibrillation and back again to Flutter. These changing conditions are clearly shown either by electrocardiograms or polygrams. Sometimes both are necessary to elucidate exceptional activities.

Auricular fibrillation and flutter merely represent differing degrees of auricular contractions, or spasms. When the rate does not exceed 200-300 per minute, they are classed under the term fibrillation; when they surpass it to a certain point, they are known as flutter. The rapidity in the latter is very great. Except under effectual medication, the auricle beats under these conditions much more rapidly than the ventricle, usually maintaining a rate at about 2-1. There is in such cases not a defect in conductivity (or in other words, incomplete heart block), but a shower of stimuli coming simultaneously or successively from different auricular centers. In auricular fibrillation, the auricle is then actually in a paretic condition. While it is fairly full during diastole, a series of minute convulsive movements, which are in reality imperfect local contractions, are constantly taking place in one part or another in the walls of the sac. They are shown as wavelets in polygrams. (See Fig. 5.)

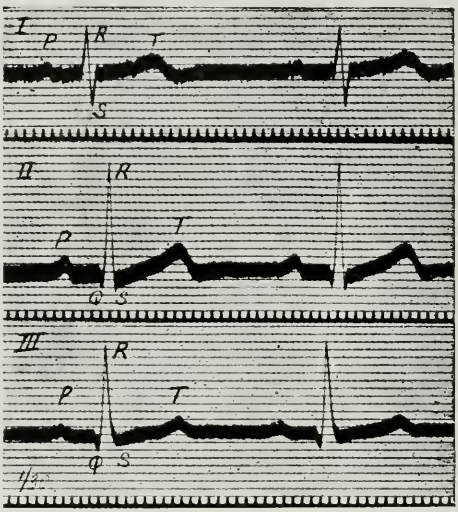
There is an allied condition which has recently been called "flicker." Here the vibrations may reach as much as 3,000 or more per minute. They can be induced experimentally by stimulating the vagi. (Rothberger and Winterberg, *Wien. Klin, Woch.*, May 14, 1914) Auricular fibrillation can also be caused by mere pressure on the vagi. When, in such instances, the impulse fails to activate the ventricle, the condition is known as "Ventricular escape."

One of the most characteristic conditions entering into auricular fibrillation, is the auricular paresis that has been referred to. At first it was thought to be paralysis.

In order to facilitate an understanding of this paper, schematic examples of normal electrocardiograms and polygrams have been introduced. (See Figs. 1, 2 and 3.)

P represents the auricular wave. R, the initial ventricular wave. T, the final ventricular wave. Q is the negative wave following contractions of the His muscle. S the negative wave following the initial ventricular contraction R.

The normal auricular wave P, of the electrocardiogram (Fig. 1) is now supplanted by a series of waves up to 200 or 300 to the minute, as



I have already stated. When they rise above it in the hundreds, the condition is known as flutter; when they reach into the thousands, the condition is known as flicker.

It should be understood that the auricles are reservoirs rather than pumps. They are never emptied, even in health, for their so-called valves are really ostia that do not close. The muscular coats of the auricle are also very thin, especially the left. Auricles are, in fact, sacs that are easily distended but have little propulsive power. It is this flabbiness of their tissues that contributes, more than failing ventricles, to heart failure.

The cause of fibrillation has seldom been traced to a pathological lesion.

Oppenheimer (*Proc. of the N. Y. Path. Soc.*, November and December, 1912) has recorded one instance, however, where a calcific plate was found in the left auricle.

A. E. Cohn and J. D. Heard (*N. Y. Med. Jr.*, July 26, 1913) found in a similar instance a lesion of the sino-auricular node, but without being sure of any casual relation between the disease of the node and the arrhythmia.

Neuhof, however (*Med. Rec.*, Dec. 1, 1915), has reported a case where auricular fibrillation was associated with an acute pericarditis. Fibrotic deposits sometimes occur in the auricle. It is usually, however, credited to myocardial disease, and the characteristic waves in the electrocardiogram regarded as significant of myocardial disease are quite apt to be present. It is not unlikely that the cause at times may be a heart strain. According to White (*Boston Med. & Surg. Jr.*, Dec. 2, 1915) it is also apt to be associated with the lithaemic condition, arteriosclerosis, hyperthyroidism and the syphilitic heart. And so, we may at least say we are gradually approaching a knowledge of the causes of fibrillation, though the data are as yet fragmentary, at any rate, so far as they bear on pathological lesions. Yet fibrillation may be functional. G. Canby Robinson (*Archives of Internal Medicine*, Feb., 1914) has reported a case where a transient form was caused by pressure on the vagus. It can also be produced by electrical stimulation of the vagi. (Rothberger and Winterberg, *Arch. f. d. Ges. Phys.*, 1910, cxxxi, 387 et seq.) and by cloroform, tobacco and tea (McWilliams, *Boston Med. & Surg.* 31, Oct. 10, 1914). I have come across it in the jugular pulse tracings of a boy who had the juvenile type of arrhythmia (sinus arrhythmia). It may also be due, I think, to neurotic conditions. But these physiological examples of auricular fibrillation, being of the transient type, are not causes for alarm.

In fibrillation not relieved by medication, there is apt to be great shortness of breath on exertion, though not necessarily while resting; intense or violent precordial pain, greater, as a rule, than in any other form of heart disease. Sleeplessness at night is another marked feature. The heart beats are apt to be excessive, but only a certain number reach the wrist, so that with an apex beat of 120, the radial pulse may be about one-half, a 2-1 relation, approximately. This deficiency of the pulse has given to the condition the name "Pulse deficit." (Hart, *N. Y. Med. Rec.*, Jan. 11, 1913). Murmurs may or may not be present, but coupled beats are sometimes noticeable. There is also no uniformity in the interventricular intervals. This latter is one of the most characteristic features and best shown in an electrocardiogram. But there is also a paretic difficulty, when convulsive contractions take the place of the normal ones. These are well shown by the above mentioned instruments of precision. Of the four principal signs, it will be noted that at least three are distinguishable without the aid of special instruments.

The signs in both auricular fibrillation and flutter are as follows:

1. A pulse deficit in which a large number of ventricular contractions are not felt in the pulse at the wrist.

2. Complete lack of co-ordination between the jugular and radial pulses.

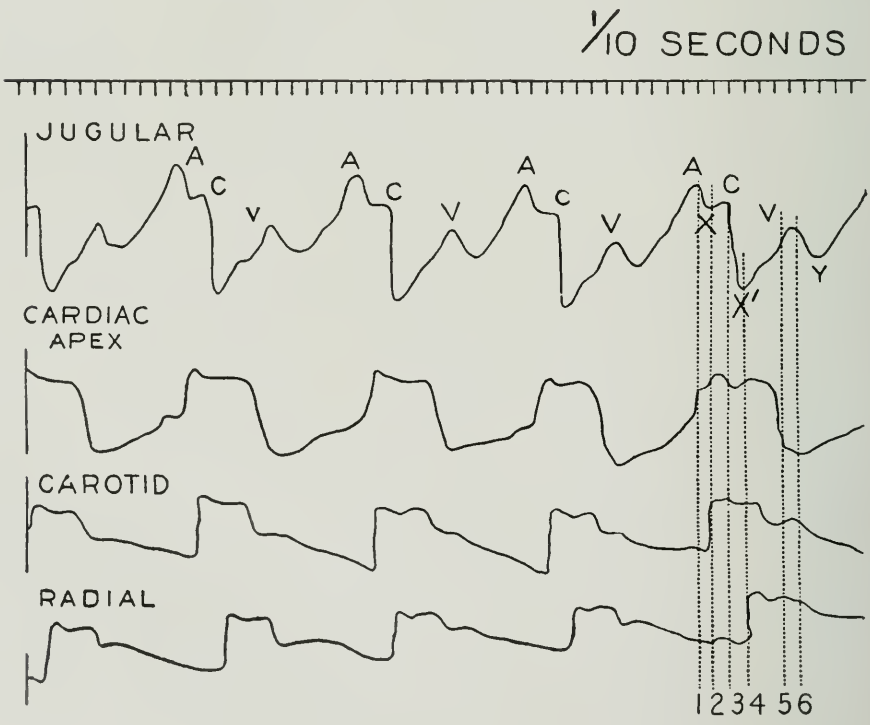
3. Great variation in strength between the beats, best shown by the electrocardiogram.

4. Complete lack of uniformity between the interventricular intervals.

5. Usually a rapid action of the heart.

6. Control of this condition to a large extent by digitalis or strophanthus.

The fluoroscope will also show dilation of the auricles at first, before the contractions which follow the use of suitable medication. Similarly, the roentgenogram will in some instances demonstrate a dilated auricle satisfactorily. In doubtful cases, by comparing the electrocardiograms or polygrams in question with the normal types as shown in Figures 1, 2 and 3, one should be able to differentiate auricular-fibrillation in the light of the first five differential signs above given.



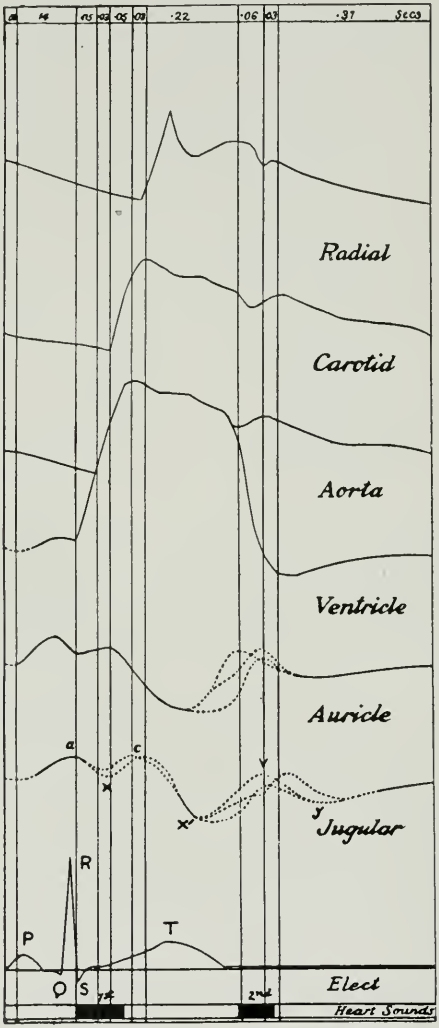
The polygraph, however, is in my opinion, the best single instrument, on the whole, available at the present time for interpretation of these and other cardiac anomalies, if in the hands of an expert. It is especially valuable for clinical work. The electrocardiograph combines the use of electricity and photography, and is essentially a laboratory machine: and yet it has the advantage over most polygraphic machines that it operates automatically, and registers normal and pathological conditions in auricular contractions more definitely than the polygraph. Neither of them, however, furnishes a record that is absolutely correct in point of time. We usually judge of the auricular rate by the jugular, and in so doing, the interval of time lost is normally about 1/10 second, with a further loss attributable to the mechanical operation of the instrument, that is from 1/10 to 1/5 of a second. In an electrocardiogram the contraction of the ventricle is heralded by contraction of the papillary muscles, which is apt to be in normal cases, 1/20 of a second in advance of the actual contraction of the ventricular walls, as a whole. (It may be noted here that in the author's Automatic spring recorder, the ventricular waves are contemporaneous with the beats of the radial pulse, but the principle on which it is operated differs from that of any other machine.)

In the jugular tracing, A represents the auricular wave, C the carotid wave, V the ventricular wave. X denotes auricular relaxation; X, auricular diastole, while Y indicates ventricular diastole. The dotted lines marked with numerals indicate the contemporaneous waves and depression of the various vessels.

Of course, we must realize that in graphic tracings the strokes that represent the contraction of both auricles and ventricles are always composite, being made, upon the one hand, of the two auricular contractions which are not quite simultaneous, or of those of the two ventricles, which also contract separately. Such are the conditions one has to face in the interpretation of all polygrams and electrocardiograms. In this connection, it may be interesting to know that according to Crane (*Am. Jl. of Roentgenology*, Nov. 17), auricular fibrillation can sometimes be differentiated by the X-ray.

The reason is that the auricle in this condition, as has been said, is almost immobile, and distended; but yet if the individual is too fleshy, cannot be put in the horizontal position, or if there are deposits in the thorax, the radiogram may yield no satisfactory information. Doubtless, however, the possibilities of radiography in this regard have not been reached. It is interesting also to know that Dr. I. Seth Hirsch, of this city, has been able to secure pictures showing both auricular movements and distention.

In the vast majority of instances, a diagnosis can safely be based on the entire lack of uniformity in time between the interventricular intervals. This particular point is best determined by either an electrocardiogram or a polygram.



In the prognosis, we must bear in mind that auricular fibrillation may be transient, never returning; or on the other hand, it may be chronic and incurable; and that the prognosis apparently bears largely on myocardial efficiency. In the acute infections, such as diphtheria, fibrillation may disappear as the infection diminishes. But if there is a neoplasm or rheumatism, a syphilitic or fibrotic deposit, entailing any

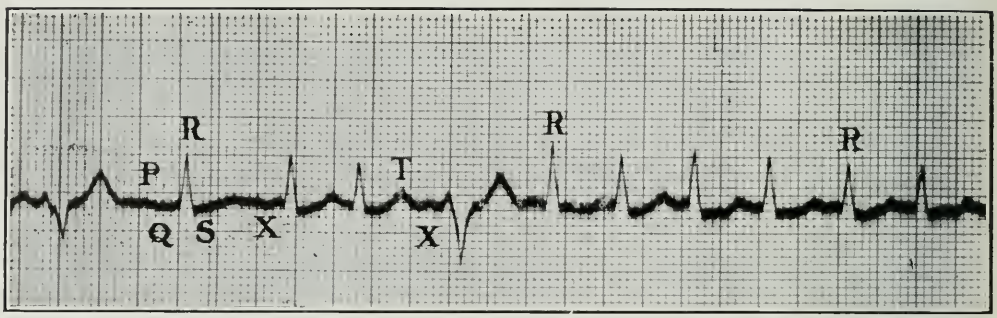
permanent change in the integrity of the auricle or its operation, the disease will continue. And yet, if by suitable medication the abnormal subjective conditions, such as the precordial pain, tachycardia, weakness and sleeplessness, are relieved, the patient may, except for an intercurrent affection, lead a fairly comfortable life for some years. The prognosis also depends on whether the patient will bear the medication and keep it up.

By the use of strophanthus and digitalis, the auricle is slowed up, so that it has a chance to rest. In the treatment, the primary aim should be to reduce the pulse rate to the normal and the dosage of these drugs should be sufficient to hold the pulse down. Digitalis depresses the activity of the conducting tissues and in this way accomplishes the desired result. Continuous medication, however, is absolutely necessary, but it is of paramount importance that that drug shall be of a form well borne by the stomach, if the treatment is to be prolonged. At the same time, heart pain can be relieved by glonoin in 1/50 grain doses and sleep can be produced by veronal in 5 grain doses. After temporary relief has been obtained, one should always try to reach the underlying cause. If there is reason to believe that there is syphilis or rheumatism, the iodides, mercurials or salvarsan, should be given to the point of toleration. In transient auricular flutter, however, digitalis is a doubtful remedy. In some cases, possibly, it may do more harm than good.

The above (Fig. 3) represents a normal type of electrocardiogram as contemporaneous with normal types of carotid, aortic, apex, auricular and jugular tracings; showing also their relations in point of time to the heart sounds, and the duration in fractions of seconds of their various activities. The lettering of the polygrams and electrocardiogram in Fig. 3 are those now accepted as standards in this country.

This illustration gives a fairly correct view of the contemporaneous happenings in the different cycles, though, there is such a variation in any individual in the length of the cycle and in the prominence and position of the waves and depressions that no one of the tracings can be considered as more than approximately correct, in its relation to any one individual tracing.

In the differentiation of auricular fibrillation, we have to distinguish it (1) from sinus arrhythmia, which represents merely a variation from the normal within physiological bounds. This is a temporary affair and may be caused by forced respiration or swallowing, soon subsides, and can be inhibited by a 1/60 grain of atropin, which depresses the action of the vagus; (2) Extra-systolic arrhythmia, which is an example of irregular action in the cardiac chambers, where extra, i. e., intercurrent systoles take place. They are of varying types. In the auricular form, the entire complex as shown by the polygram is small. The compensa-



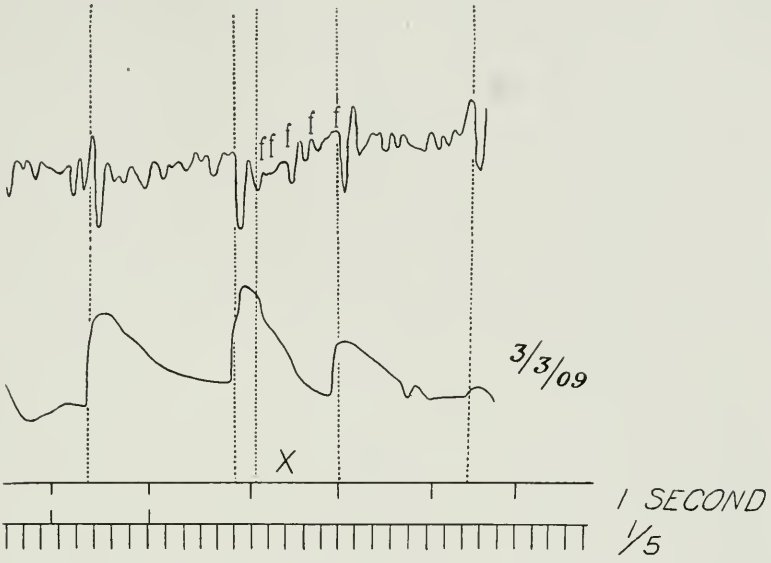
tory pauses are also short as compared with those of the ventricular type where the length of the pause is about one-half of the preceding and following pause combined. In the first instance, the impulse, instead of originating from the sinus, starts from some other part of the auricle. In the latter, it starts from some part of the ventricle. For example, in mitral disease and dilatation of the left auricle (as in myocardial disease causing dilatation of the heart chambers) this condition might cause the impulse to develop from the dilated part of the auricle. On the other hand, failing compensation causing failure of the left ventricle, could cause the auricular fibrillation to assume the ventricular type; or (as in one of my cases) it might cause ventricular fibrillation.

Subjectively, the signs of extra-systole are a sudden thud in the chest, perhaps with a sense of acute pain. Also, as the normal rhythm is interrupted, the extra contraction will be heard over the heart and felt by the finger on the pulse. But the distinction between the extra-systoles of auricular or ventricular types can only be detected by the electrocardiograph or polygraph for they, only, can distinguish clearly the peculiar complex of waves in the auricular form, and the long compensatory pause of the ventricular form.

Sometimes, and often, the extra-systoles are caused by the pressure of gas on the heart externally or from the use of tea, tobacco or coffee. Then the sharp stroke after the long pause will give an unpleasant nervous sensation, but the danger to life is inconsiderable. However, it may call attention to matters of more importance, for it is apt to be associated with other heart anomalies. Extra-systoles are not common when the pulse rate is over 100.

(3) In heart block there is as a rule the slow arterial pulse as compared with the venous. In very exceptional cases only, it has been as high as 70 (Manges). It may be partial. In complete heart block where there is no fixed time-relation between the A wave of auricular contraction and the C wave of the carotid (See Fig. 2). The two heart chambers are seen to beat independently of one another.

(4) In Adams-Stokes disease, the loss of conductivity is associated with syncopal attacks. When the pulse rate varies around 30 to 40, the patient should be given a 1/60 grain of atropin. This eliminates the vagus action when as a rule the slow ventricular rate will tend to rise toward the faster auricular rate. Heart block may be caused by syphilis, fibrosis and neoplasms and as its causes may be the same as



those of auricular fibrillation, one form of arrhythmia passing over to another. This condition may also be produced by pressure on the vagus in its course or at its root, as in a case of mine with hemorrhage at the base of the brain. Acute infections such as diphtheria and typhoid also cause it. If the block is relieved by atropin, the cause is functional.

(5) Ventricular fibrillation is extremely rare. The case recorded by me (*Diseases of the Heart and Blood Vessels*, 1918, p. 34) was, I believe, the second on record. The normal interventricular waves in this form of arrhythmia are supplanted by a series of large waves of a peculiar character. This patient of mine had failing compensation and I am disposed to believe that we shall find it not uncommon in the heart agony of approaching death.

(6) Pulsus alternans is the last of the arrhythmias from which we may be required to differentiate auricular fibrillation. We can, in well developed instances, detect this condition by the fingers, but it is always shown, if present, with definiteness by the electrocardiogram or polygram.

By comparing electrocardiograms or polygrams with the normal types, as seen in Figs. 1, 2 and 3, a diagnosis of auricular fibrillation can be made, if the criteria necessary for a differentiation diagnosis, as already given, are held in view.

The following are illustrative tracings, Fig. 4:

Aortic stenosis. Mitral regurgitation, tachycardia. Lead II. No definite P wave. Interventricular time completely irregular. XX. Extra-systoles of various types. T waves variable. R waves of varying force. Larger intervals 1/5 sec., smaller intervals 1/25 sec. (Electrocardiogram by Dr. H. J. Spencer, New York Hospital.)

Fig. 5—Adams-Stokes disease where the arterial pulse was 36. Fibrillation in the space X at the rate of approximately 300 to the minute, as shown by the larger waves. The lower waves are those of the author's spring recorder. These waves are synchronous with the radial pulse. The upper waves are those of the jugular. If the smaller waves were reckoned in, the case would be one of auricular flutter. (By the author.)

DISCUSSION ON PAPERS BY DRS. BEATES, ZUEBLIN, WILCOX, McFARLANE, CORNWALL, BISHOP AND SATTERTHWAITE.

Dr. Jacob Diner of New York said that Dr. Beates' paper on the physiological standardization of drugs was of considerable importance to the pharmacologist. There was, however, no uniformity as to the best method of standardization. Many methods had been suggested, but until pharmacologists were united in their suggestions pharmacological control was an impossibility. Where the Pharmacopœia was used as a guide the Pharmacopœial Committee might be responsible for any damage done. If they stated the maximal dose that could be given they might legally be held responsible for ill effects to any patient who might be susceptible to a given drug. Therefore an average dose was in all cases stated. It was assumed that the practitioner would know best how to employ the physiological dose in a given case. No drug had a given dose. There were always examples of different inactivity. In the laboratory one could only take the average according to the number of animals employed. One never based conclusions on a single animal. There were idiosyncrasies in animals as well as in human beings. The duty of the physician was to determine the given dose for a given patient. In regard to Pignet's formula, he presumed that the metric system was used, and not inches and pounds, or the latter would give a minus quantity.

Dr. Douglas Vander Hoof of Richmond, Va., said that these papers were excellent and entertaining. All were indebted to Dr. Satterthwaite for the valuable work presented in cardiovascular investigation. The principles governing arrhythmias had only been worked out within the last ten years. To many men, certain types still were confusing. The sinus arrhythmias in children were very common. One was called by the anxious parents, who had put the child to bed for irregularity of the heart action. These children did not need treatment for the heart, but they needed hygiene, and plenty of exercise. Putting them to bed did more harm than good. Dr. Bishop's paper on ipecac was an eye opener. Had he used ipecac without digitalis in these cases? Dr. Beates had presented a well-timed paper. The great

vice of the profession was apathy. They all went back and prescribed galenicals which had been shown time and again to be unreliable. Dr. Beates had done distinct service in presenting this communication. The older men had been accused of using placebos. The doctor gave bread pills to fool the patient, and the patient threw them out of the window to fool the doctor. The same thing practically was done now, only unintentionally. By prescribing galenicals the modern doctor was giving placebos. The doses prescribed in many textbooks were absolutely innocuous. In achylia, one or two minims of hydrochloric acid were prescribed, instead of one or two drams. All had been greatly impressed by Dr. McFarlane's talk. These cases were occasionally seen in civil life. One would have been glad to have had more extensive laboratory investigations in those cases cited. The designation of "neurocirculatory myasthenia" did not cover the whole question. They were dealing with a focus of infection—teeth, tonsils, etc.—and unless a routine Wassermann was made there were still points to be cleared up. Many of these patients would show achylia, on gastric analysis. They had achylia gastrica with secondary intestinal toxemia. They often showed a secondary vasomotor instability. Dr. Cornwall's advice as to rest in the cardiac cases was very commendable. In all cases prolonged rest was not possible. In the cases of cardiopaths, business men who found it impossible to leave their business entirely, one day each week in bed gave them a good measure of rest and comfort. Staying in bed each Wednesday and half the day on Sunday was extremely helpful. He would like to hear more of the lacto vegetarian diet, as advocated by Dr. Cornwall. Did this lower blood pressure? Dr. Vander Hoof had one patient, an extremely successful lawyer, aged 35, at the top of his profession, of excellent physique and habits. Life insurance examination disclosed the fact that he had a blood pressure of 200 systolic, and retinal hemorrhages. He went to Nauheim and was put upon a diet of milk, cereals, and vegetables. He was on that diet till death two and one-half years later. The blood pressure remained constant, and he died of cerebral hemorrhage. Another patient, a woman of 52, leading a most careful life, had a systolic pressure of 210. This remained constant in spite of diet. These facts made the question of diet and blood pressure rather confusing. It would seem as if diet played a very minor part. Dr. Vander Hoof said he would be glad to be convinced if some one would furnish proof that diet did lower blood pressure.

Dr. Ernest Zueblin of Cincinnati said that he was much interested in the *x*-ray pictures of the bulging of the right heart in auricular heart lesions, as shown in Dr. Satterthwaite's series. Although in his personal opinion the advantage of stereoscopic *x*-ray plates over flat plates in the dissociation of *x*-ray shadows were evident, he called attention that in chronic heart disease the adjoining lung presented also an infiltration which on a flat and single plate may be ascribed as belonging to the heart and pericardium proper. Such a density might be due to circulatory disorders in the lung itself and with the increased cardiac action of the heart could reveal a pulsating movement. In regard to the instability of the drugs, he was very much pleased to see his opinion confirmed by other investigators. He had already published part of his studies of radioscopic examinations of drugs, which experiments showed the gradual decrease of radiation corresponding to the lessened therapeutic activity. These drugs even protected from light, from humidity, and kept at constant temperature for months and years revealed the same process of disintegration. In his opinion great stress had to be laid upon fresh and well preserved drugs in order to obtain better therapeutic results. He demonstrated charts of digitalis and strophanthus preparations which had been tested at various periods, illustrating the gradual deterioration.

Dr. Cornwall said that Dr. Vander Hoof's question, if the "easy diet"—*i.e.* the regulated nearly or quite lactovegetarian diet—really did produce the results claimed, was a pertinent and vital one; and in answering it he would say that there were few conclusions in medicine based on clinical observation that seemed surer to him than that this easy diet greatly relieved the symptoms of cardiovascular disease and prolonged life and usefulness. In fact, where there was any serious sickness, either acute or chronic, an easement of the dietetic burden was rationally called for; even the animals knew this, and stopped eating for a while when they were sick; and the loss of appetite which was naturally present in most diseases was a rational suggestion of nature. In regard to the conditions with high blood pressure, most striking results often followed the taking of an easy diet, with little or no animal flesh in it; for reducing to a lower plane and keeping there a persistently high blood pressure, this diet was far and above the most effective thing. Of course there were some cases with high blood pressure which no modification of diet could relieve, but they were cases of advanced nephritis or arteriosclerosis or particular circulatory obstruction which imperatively called for the high pressure as a compensatory thing. In regard to strophantin, Dr. Cornwall said that when the larger doses were given hypodermically morphine often was also called for, and could be given in the same deep injection, thereby relieving the pain of the injection, when that was prominently present; but he wished here again to record his observation that strophanthin did not always or regularly produce severe distress when deeply injected, and that often it did not produce enough disturbance to cause the patient to complain about it; especially if the strophanthin was dissolved in a full hypodermic syringe of water and thus injected. In regard to the use of belladonna, was it not possible that the employment of hyoscyamus might be preferable for the use indicated? Some authorities believed that the latter had less tendency to dilate the pupil and affect the accommodation than the former. The alkaloids in belladonna consisted principally of a mixture of atropine and hyoscyamine, the latter being readily transformed into the former, and practically identical with it in action. The important constituents of hyoscyamus were the alkaloids, hyoscyamine and hyoscine, the former existing in much larger amount than the latter. Hyoscyamine, as just stated, was practically identical in its action with atropine. Hyoscine, or scopolamine, as it is also called, resembled atropine in its action when applied to the conjunctiva, except that the effect passed off more quickly. Possibly this fact accounted for the opinion of some observers that hyoscyamus had less tendency to interfere with the pupil and accommodation of the eye than belladonna. Referring to bismuth preparations, some years ago he had occasion to investigate the comparative spreading properties of bismuth salts as ordinarily occurring on the market, or lac bismuthi, a non-proprietary preparation of basic carbonate, made by precipitating a dilute solution of subnitrate of bismuth in a very dilute alkaline solution, and dispensing the same in the form of minutely divided suspension. This minute state of subdivision gave cream of bismuth enormous spreading power, as could readily be demonstrated by administering it to a rabbit or other animal and then examining the intestinal mucosa with a microscope. Therapeutically its effects were superior to the bismuth salts as usually dispensed, the reason therefor being readily demonstrated by a similar test. Magnesium sulphate had been referred to. It might interest those present to know that a patent was granted early in 1917 for flavoring Epsom salt with aromatics. The report of the committee on patent-law revision of the A. M. A. so stated.

Dr. Henry Beates of Philadelphia stated he would like to quote from that too little known and valuable brochure of Harrington Sainsbury entitled "Principia

Therapeutica," which so tersely explained the relationship existing between the circulation through the myocardium and the arterial blood pressure, and this, again, as related to the vitality of the patient. "Let us suppose a case of heart failure, no matter its cause, in which the left ventricle is unequal to its task, and, in consequence, the blood pressure is low in the ill filled arteries, the capillary stream sluggish and the great systemic veins congested. To attack such a problem as this with digitalis, a drug which by causing contraction of the arterioles sets up a new impediment to the already overburdened ventricle, this, at first sight, would appear to be the veriest midsummer madness; yet this very thing we do, and do again with *great success.* In explanation let us observe the steps which follow upon the administration of this drug. First, the arterioles contract and the blood, gathering behind the obstruction, begins to distend the arteries; the arterial distension is immediately followed by an increased gathering of blood within the ventricle, the pressure here rises and the heart muscle, responding to the stretch of its fibers by a more vigorous contraction, expels a large volume of blood into the aorta. We have, in fact, then, made a further call upon our already enfeebled heart, and its impoverished reserve stores are by so much the poorer. But observe what now happens. The increased volume of blood thrown into the aorta causes a corresponding rise in the aortic blood pressure, and on this there follows a more forcible recoil upon the semilunar valves and in fuller stream the blood enters the coronaries. Accordingly the first capillaries to feel the effects of the blood pressure rise are those of the heart muscle itself. The improved circulation through its fibers raises its vigor and the heart, repaid now for its recent exertion, is prepared to respond to the stimulus of an increased intraventricular pressure by another more vigorous contraction. Slowly the whole aspect of the case changes: the arteries become well filled, the pulse more regular, forceful and measured, the capillary circulation freer and more sustained, the venous system less gorged. This is no question of theory or of interpretation, it is a sequence of events daily witnessed, not to be denied; neither is there any need to dispute the facts; for as we follow step by step this sequence the seeming therapeutic paradox that the proper treatment for a failing heart is to increase its burden, finds its simple explanation." Should the myocardial and arterial retrograde changes be such as to be beyond restoration the above phenomena would be impossible; again, should the vital unit with which the patient was born be almost spent, recuperative processes could not be activated. The practical point of vital import was to treat apparently hopeless conditions upon the principle of the Harrington Sainsbury therapeutic paradox, because experience proved that very frequently, where success was believed impossible, the test proved to the contrary. In this connection it would be well to bear in mind an histological fact too frequently overlooked, to wit: cells of all structure, excepting the splenic corpuscles and some perivascular lymph spaces of the central nervous system were not in direct contact with the blood. They were bathed with intercellular fluid, metabolism and functions were conditioned upon the normality of this intercellular fluid and the normality upon a mean pressure existing between the arterial side of the circulation on the one hand and the venous on the other. The fundamental principle to be applied in circulatory disturbances was therefore to be utilized in the treatment of metabolic and nutritional diseases as well as myocardial.

Dr. Zueblin said that for a final conclusion regarding ouabain medication a study of a great number of cases was required. He would not claim that ouabain would always help. It was one of the remedies that should be at hand in emergencies. It should be judiciously tried, but not repeated too often. It should be followed up by another medication—perhaps digitalis, perhaps strophanthus. Dr.

Cornwell recommended the use of smaller doses of strophanthus. There was evidence that small doses of an active drug produced better results than large doses of an old preparation. In his observation the ionic properties of drugs had a great bearing upon therapeutic efficiency, and a great deal of information ought to be dug out by further experimental studies dealing with colloid chemistry and its relation to cell function. A better knowledge of these relations would be a help in therapeutic efficiency and an asset to the medical profession.

Dr. Andrew McFarlane of Albany, N. Y., said that his work was very superficial. It was impossible to get the work done with the thoroughness desired, as the laboratories in the camps were crowded to the utmost. In the South there were so many hundreds of examinations to be made for hookworm and tubercle bacilli. He tried to make some inquiries as to gastric capacity and defecation, but as far as answers went these things seemed to be normal. In presenting this subject it was not easy to make the necessary tests. In regard to high blood pressure, he thought that in man and in woman this was an entirely different proposition. What caused the high blood pressure? In man, toxic elements played a larger part. A woman might have a blood pressure of 200 and go on living quite comfortably. In man, he had often tried to reduce high blood pressure, but sometimes without result. Venesection had been found a satisfactory method. This could be done easily and satisfactorily with the aspirator. It made no mess with the blood, which usually so frightened the family, and by inserting the needle into the vein 12 to 14 ounces of blood could be withdrawn with no trouble, and no sign of bloodshed. One could tell exactly how much blood was removed. Rest should include physical rest, dietetic, and mental rest. There should be a therapeutic compromise between rest and exercise. It was a very wise man who knew just how to balance these two necessities.

Dr. Bishop said that his paper was merely suggestive. He had not tried ipecac alone, but always in combination with digitalis. In regard to Dr. McFarlane's paper, as a member of the Advisory Board he was interested in the special rôle of the heart. He had been impressed by this type of patient. When looking for the left ventricle they did not seem to have any. In the electrocardiogram these patients' hearts were relatively right-sided. They represented a heart that was a reversion to the infantile type. When the child was born there was no left-sided preponderance. In the first few hours of life the left ventricle came into its own. He did not know how to classify this type of individual. Dr. Mackenzie had spoken of their having "x-disease." They had the disease that the specialist they went to happened to treat. They showed cold cyanosed extremities, a systolic sound, and when fluoroscoped the heart was found in the middle of the chest, like congenital heart cases. One could not convict these people with heart disease; as far as the heart was concerned they might go on with their work. Some few of them were definitely congenital heart cases, with moderate pulmonary stenosis, possibly open foramen ovale. But the type certainly presented reversion to infantile characteristics. One thing that stood out in the speaker's mind after taking thousands of polygrams and hundreds of electrocardiograms, these arrhythmias were not distinct entities, but merged one into the other. People started with palpitation, later they had flutter, and they might go on to fibrillation. The underlying cause was probably one and the same. It was no doubt toxicity. As to diet, it seemed that the heart was an engine that ran by the explosion of food. Like the gas engine, the best fuel for it was the one that left least waste to be cleaned up. It would seem then that the lactovegetarian diet best fulfilled this condition. In regard to fuel, a very observing Englishman had cured a great many cases by stoking them up with cane sugar. Dr. Bishop had a patient last winter, at Newark, a very obese woman, who had tried a reduction cure, and her

heart was down and out. The Newark doctor telephoned one day to say she was in an extreme condition. The idea came to his mind to suggest the use of cane sugar. This was tried and the patient immediately got better. He could not say whether this was a random shot, or whether there really was a good deal in the theory. The best food, it would seem, would be the one to burn with least residue, and if instant energy were required it would seem that cane sugar filled the requirement. Old people did not need to have their structures built up, and so the proteins were not required. A carbohydrate diet would seem to be sufficient. As to the question of rest and exercise, he did not do anything but consultation work, and he did not therefore observe people in bed for a long time. He had to prescribe what exercise was needed. Sometimes he had the pleasure of liberating people from unnecessary confinement, but sometimes he had to advise the opposite thing. In regard to the electrocardiograph, it was an autograph of the heart's action. He did not believe that the intricate interpretation of these things was necessary, but he did think that the profession needed to learn more or less what was shown. He was beginning to collect these tracings, with the idea of teaching the profession what these things looked like and what they indicated. Many men at medical societies, when shown these things, took them in their hands upside down.

Dr. Satterthwaite said that rest and exercise were both essential. In children, especially in endocarditis, to get a satisfactory cure they had to rest in bed. That rest might be for two or three weeks, or for as many months. Another condition requiring complete rest was fibrillation or flutter. One could not control it without putting the patient to bed. Rest in the horizontal position was essential. Exercise was just as necessary in some chronic cases. The Nauheim cure commenced with passive exercise and graduated walking distances. Keeping the patients too long in bed put them back. After a while it became necessary to get out and take moderate exercise. In regard to "irritable heart," the society owed a debt to Major McFarlane for his talk. Da Costa, in the Civil War, used this term until Sir Thomas Lewis changed the term to "effort syndrome." This emphasized the idea that there existed a muscular weakness, but he thought that Major McFarlane's term carried out the idea further; he had called it neurocirculatory myasthenia. That was a distinct progress. One should, however, regard Sir Thomas Lewis as the foremost exponent of the physiological action of the heart. The cure was effectively graduated exercise. There was a neurotic element behind all these cases. The introduction of the adjective "neuro" into the term was illustrative of the condition. There might be something more behind that, but the neurotic element was certain. In reference to diet, they would agree with Dr. Cornwall that in acute infection or acute exacerbation of heart disease one should limit the diet to milk for several days, followed by a more liberal diet. The general diet had to be studied according to the individual requirements; one could not lay down hard and fast rules. The diet must be restricted, the stomach must not be overloaded, food must be satisfying and yet not heavy. In regard to the use of morphine, he had never employed it, having had success with the use of bromides and veronal. He felt a fear of using morphine. It did the work, but it had the danger of habit-forming. The physician should reasonably fear to have the charge of habit formation laid up against him in these chronic cases. Dr. Vander Hoof had said that one was often disturbed by the irregularity of the heart in boys and girls. In sinus arrhythmia the heart was extremely irregular, weak, and changing in character. This was a frequent condition of growing youth. It required no treatment except regulation of manner of life and general hygiene. People were unnecessarily alarmed, but the condition was transient. As to the high blood pressure, this question had become a nightmare. Patients came one day with

a pressure of 200, without any change, another day showed it to be 150, then 180, then 140. There was a neurotic element in such cases, but a good deal of study had to be done on that as yet. Many people had cerebral hemorrhage with a low pressure. Insurance men required a pressure of 28 to 30 diastolic. Doctors never saw that; they saw 60 to 80. One did not know that a low pressure was normal in diseased conditions, and it had not been worked out what the average blood pressure should be in tuberculosis or uremia or diabetes, for instance. While they knew the normal they did not know what it should be in disease. People did fairly well for a long time with high blood pressure. In reference to the shadow of the heart shown in the skiagram, Dr. Hirsch claimed that it was due to the vibrating of the heart and dilatation of the righ auricle. That was the interpretation of the *x*-ray man. Dr. Satterthwaite was not absolutely convinced that they were getting skiagrams of actual auricular disease.

Papers Read by Title.—"Modern Therapeutics in the New York State Hospitals for the Insane," by Spencer L. Dawes of New York; "A New Case of Uterine Rheumatism and Its Management," by William A. Porter of New York; "Phenylcinchoninic Acid," by Reynold Webb Wilcox of New York; "The Physiological Chemistry of the Duodenal Contents in Cholelithiasis," by John C. Hemmeter of Baltimore.

Election of Officers.—The following officers were elected: *President,* Dr. Douglas Vander Hoof, Richmond, Va.; *First Vice-President,* Dr. Harry B. Anderson, Toronto, Canada; *Second Vice-President,* Dr. Thomas E. Reilley, New York City; *Third Vice-President,* Dr. C. F. E. Mattison, Pasadena, Cal.; *Secretary,* Dr. Lewis H. Taylor, Washington, D. C.; *Treasurer,* Dr. Spencer L. Dawes, New York City. *Council,* Drs. Noble P. Barnes (1921), chairman; Robert T. Morris (1921), vice-chairman; Lewis H. Taylor (1923), secretary; Thos. E. Satterthwaite (1919), John Blake White (1919), G. H. Evans (1919), Wm. A. Campbell (1920), W. Wayne Babcock (1920), F. M. Pottenger (1920), Jacob Diner (1921), A. D. Blackader (1922), C. E. Jennings (1922), J. N. Hall (1922), S. L. Dawes (1923), Stuart McGuire (1923). *Committee on Admissions,* Drs. Satterthwaite, Pottenger, and Jennings. *Editor of Transactions,* Jacob Diner, New York City.

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